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EDITORIALS

OBSTETRIC EDUCATION

IN 1935, in this Journal,[1] I discussed at some length the reasons for a combined department of obstetrics and gynecology in our medical schools and affiliated hospitals and also directed attention to the fallacies in the arguments advanced by a few who desire to separate gynecology from obstetrics and place it under the too all-embracing cloak of general surgery. Since that time, personal communications from many teachers of our specialty throughout the country, have convinced me that the broad educational principles held by the great majority of the teachers in our Class A medical schools require a unified department of obstetrics and gynecology. It is equally clear that where gynecology is separate or under surgery, tradition, often initiated and perpetuated by some individual in a position of authority but without proper or adequate training in either obstetrics or gynecology, private or personal interests or ambition, and the lack of a broad and sound educational policy, are among the main forces preventing the development of a unified department along the lines of the German, "Frauenklinik." Even today we still have instances among our Class A schools where obstetrics is a surgical subdepartment!

It appears that there is full agreement among the chiefs of maternity hospitals and services, as well as among the deans and heads of obstetrical and gynecological departments in our schools, that the chief factor responsible for our high maternal death rate in this country is the inadequate teaching of obstetrics and gynecology to the under-graduate medical student. This concensus of opinion was clearly revealed by that excellent study of the Committee on Prenatal and Maternal Care under the auspices of the White House Conference on Child Health and Protection.[2] I can do no better

[1] Stander H. J. Teaching of obstetrics and gynecology in the United States. *Am. Jour. Surg.*, 28: 61–66, 1935.

[2] Obstetric Education, Committee on Prenatal and Maternal Care, White House Conference on Child Health and Protection. New York, Century Co., 1932.

than direct the attention of our American Universities and Foundations interested in medical educations to a few quotations from the admirable report of this Committee:

Instruction in obstetrics to medical students is a desideratum of prime importance in the determination of maternal morbidity and mortality.

The departments of obstetrics and gynecology should be unified in medical schools and in all hospitals affiliated with and controlled by them.

Adequate graduate as well as undergraduate education in obstetrics is necessary to provide skilled obstetric and gynecologic care to women and to prevent the untoward consequences of childbearing. The first step needed is to complete unification of departments of obstetrics and gynecology in teaching institutions.

The European plan of the "Frauenklinik" which has been initiated in this country should be extended to all medical schools. Gynecology should be subordinate to obstetrics.

These quotations from such a deliberate and seasoned study by a representative body of teachers of our specialty, selected from schools throughout the country, make it imperative that a concerted effort be made to enlarge upon, as well as improve, the teaching of this specialty to our undergraduate medical students, and to bring together under one unified department the two branches, obstetrics and gynecology, in every medical school worthy of its name.

It may be well to point out that the Committee mentioned, studied by intensive questionnaire all the arguments usually put forth by the few remaining isolationists, but could find no logical nor sound reason for separating obstetrics and gynecology. As an illustration, the question, "Should an obstetrician practice gynecology?" was answered in the affirmative by 42, in the negative by 6, and 2 made no report.

Second in importance only to proper and adequate teaching of obstetrics and gynecology to undergraduate medical students is the hospital training to graduates of medicine who wish to specialize in this field. What I consider adequate postgraduate training has already been described in detail.[1] However, I do wish to again stress my belief that the so-called "one year rotating" internship where six and even eight services constitute the twelve months training, is of little clinical value. At the end of such time the young man or woman knows no one field adequately, or even moderately so, and one doubts whether the interests of the patient are safe in his or her hands. For the general practitioner, who cannot afford long hospital training, a minimum of an eighteen to twenty-four months rotating internship seems essential.

As all graduates of medicine who wish to practice obstetrics and gynecology cannot afford the time for a four or five year hospital training, it seems to me that a great deal may be accomplished could those hospitals, not affiliated with medical schools, offer a one year or two year obstetrical and gynecological internship. There are many well equipped voluntary hospitals throughout the country that can readily do this.

In conclusion, first, it would be well that the deans and faculties of our medical schools constantly bear in mind that the appalling maternal mortality in the United States of America may mainly be attributed to the inferior place accorded obstetrics and gynecology in the curricula of these institutions. Secondly, they should similarly realize that the two branches must be unified into one department and that the chiefs of such combined departments must have a practical as well as a theoretical knowledge of both. Lastly, the hospitals affiliated with and controlled by our medical schools, should furnish adequate and excellent training in such a combined department to every young graduate of medicine who wishes to practice this specialty.

H. J. Stander.

THE PRESENT TREND OF OBSTETRICS

IN this special number of the American Journal of Surgery, an attempt has been made to cover some of the most important phases of clinical obstetrics. The authors are from all parts of the country and form, I believe, a group representative of the best teaching and practice of obstetrics. As one reads these contributions one is impressed with the conservative attitude of every author, although no attempt on my part was made to select or invite a particularly conservative group of obstetricians. This, then, must be evidence of the present trend in our field, as distinct from the time of accouchement forcé, manual dilatation of the cervix, universal prophylactic forceps, cesarean section on all patients suffering from eclampsia, and the use of pituitrin during the first and second stages of labor.

It is apparent that cesarean section is still performed far too frequently. Even in a maternity hospital to which all types of abnormalities are referred, the cesarean section incidence should certainly be under 3 per cent. It appears to me that the only justifiable extension of this operation during recent years has been in the treatment of certain types of placenta previa, with certain definite findings.

It is, of course, inevitable that an editor cannot conscientiously agree with thirty-five authors on various phases of one subject, but it has been most interesting to me to note that such disagreements have mostly been on trivial and clinically unessential points. We cannot all agree to any particular analgesic for as yet there is no drug perfect for this purpose, but it is apparent that the obstetricians are fully aware of the whole situation, and are not being stampeded by all types of forces constantly at work.

While the mortality figures for the whole birth registration area in the United States remain to be of staggering proportions, it cannot be doubted, by even the casual observer, that great advance in our specialty has taken place during recent years. True, the benefit to patients from such advance is still limited to very circumscribed areas which provide properly trained specialists and adequately equipped and staffed hospitals. I am convinced that could such areas be extended to include the whole birth registration area, we would see a marked and steady reduction in the maternal and fetal mortality rates, as published annually by the Census Bureau.

The recent advances in obstetrics mentioned in the foregoing, include the recognition and treatment of pyelitis, heart disease and syphilis in pregnancy, the prevention and treatment of postpartum hemorrhage, the bacteriology, prevention and isolation treatment of puerperal infection, the improved methods of resuscitation of the newborn, the conservative handling of infected abortions cases, *x*-ray pelvimetry and cephalometry, more concentrated prenatal and postpartum care, the earlier recognition of nephritis or vascular disease and its more radical treatment, the development and extension of analgesia, the prevention and proper care of birth injuries to both mother and child, and a more conservative attitude in the treatment of eclampsia.

In conclusion, the guest editor of this number feels deeply indebted to all the authors of the following contributions, as he is fully aware of the willingness with which they undertook their task.

H. J. STANDER.

EDITORIAL COMMENT

TEN or eleven years ago we met H. J. Stander at the Royal Victoria Hospital in Montreal. At that time he was associated with the late J. Whitridge Williams, Professor of Obstetrics at Johns Hopkins, and already had earned a national reputation in his chosen field. To us it seemed only natural that Cornell should call him to head the Department of Obstetrics and Gynecology, which chair he occupies at present. But it was not for personal reasons that we turned to Dr. Stander to edit this number of the American Journal of Surgery specially devoted to obstetrics. We diplomatically wished the job on him because we knew that if he undertook the task he would make a thorough, workmanlike job of it. And that he has done to the last detail.

Each author and the title of every article in this issue was selected by Dr. Stander. Naturally, all the interesting phases of obstetrics could not be covered in a single issue, but it is our opinion, which is shared by scores of others, that he has used wise discrimination in his choice of the titles and the authors. It was not without a sense of guilt that last summer we maintained an active correspondence concerning the details of this number while he was away on vacation. He never for a second took the easy way out. Many of our suggestions aimed to ease his burden, he rejected; others he accepted, but always accompanied by a note of appreciation.

We and others think this number is truly outstanding. All the credit goes to Dr. Stander and to the authors he selected to contribute to this symposium.

Both publisher and editor gladly take this opportunity to thank Dr. Stander sincerely for a task extraordinarily well done.

T. S. W.

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MODERN PRENATAL CARE

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SAN FRANCISCO

THE object of obstetrical care is to conduct women through their pregnancies, labors and postnatal periods with as little damage to themselves as possible, both physically and mentally, and with the maximum assurance of the birth of a normal healthy baby. It has become apparent that these aims cannot be attained without careful examination and care during the prenatal period. Many women go through their pregnancies and labors with little or no difficulty and without significant harm to themselves. In these women the process can be regarded as a normal physiological one, and for them prenatal care proves unnecessary. On the contrary, numbers of women start their pregnancies handicapped by previous disease, such as tuberculosis, heart disease or a nephritis. In some, the ravages of the disease have been so great that it would be actually dangerous to life for the pregnancy to be carried to term; in others, less severe, the chance of successfully carrying the pregnancy to term depends largely upon proper care during the prenatal period. Still other women experience various complications of pregnancy which might be forestalled, or at least their danger made minimal, by early recognition and proper care. In this category fall the toxemias of pregnancy. Still other women destroy their chances for a successful, unharmful pregnancy and labor, or a healthy child because of poor dietary habits, excessive activity, too strenuous an occupation, or the like. For all these women, pregnancy is distinctly a pathologic process, and for them proper prenatal care assists in overcoming the particular complication which may beset them.

Since it is not always possible to predict which women will have difficulty and which will not, it becomes necessary to treat all alike and watch them carefully for the development of warning signs. It is preferable that such care start at the very beginning of pregnancy, and it is hoped that women in general are becoming educated to consult their doctors as soon as they suspect that they might be pregnant. Complete history and examination at this early stage is often of utmost importance. This point cannot be emphasized too much. For example, signs of a well marked nephritis coming on the heels of a childhood streptococcic infection may be discovered in which event abortion may be indicated, but unless the patient has consulted her doctor within the first two to three months, may be extremely dangerous or impossible. Thus, it may be a matter of paramount importance that patients be seen early in their pregnancies.

In addition to these major considerations, many minor circumstances arise in pregnancy which may prove disquieting, disagreeable or sometimes actually harmful to the gravida. The physician must be prepared to deal with these also, if he is to render good service. He must seek to gain his patient's confidence so that she will feel free to consult him regarding the many questions which inevitably arise. Patients should be informed what to expect and what symptoms to watch. False ideas and fears, not infrequently engendered by the ill-advised conversation of older women, often exist. These should be eradicated in a sympathetic and understanding manner. A close relationship of this kind between doctor and patient helps to make pregnancy a pleasant rather than an unpleasant experience.

HISTORY AND EXAMINATION

A careful history should be taken, particularly with respect to existing ab-

normalities, such as tuberculosis, heart disease, body deformity, or the like, and to past diseases which may have left a more or less permanent disability. Special emphasis should be placed upon the acute infectious diseases. History of disease in the family occasionally has significant implications. History of disease in the husband, be it venereal or otherwise, may be of importance. Previous operations or injuries may have altered anatomical conditions which might have a bearing upon the course and outcome of the pregnancy, and should, therefore, be queried. If the patient has had children, as much information as possible should be acquired concerning the previous pregnancies and labors. Such information may enlighten us tremendously regarding the probable course of the pregnancy, complications to anticipate, prophylactic measures to be taken. The amount of information regarding the present pregnancy possible to obtain will necessarily depend upon the duration of the pregnancy. Nausea and vomiting are of special importance early in pregnancy. Later, headaches, dizziness, visual disturbances, swelling of the face, hands and feet, and epigastric pain may point to an existing toxemia of pregnancy. Bleeding is of importance at all stages; it may indicate threatened abortion in the early months, or placental separation in the late months. Bowel habit, amount of exercise obtained, average sleep period, average weight, "petty bad habits" should all be investigated. A history of this kind gives a background of inestimable value, and should be obtained at the first visit.

Examination should be complete; heart, lungs, abdomen, back, nasopharynx, extremities, reflexes, blood pressure should all be included as well as the examination of those parts of more specific obstetrical interest. Should abnormalities be found, or be suggested in the history, it is wise to have proper consultation regarding the particular organ in question. Foci of infection should be sought especially in tonsils, sinuses and teeth. If found, they should be eradicated since they may enter into the etiology of subsequent toxemias, urinary infections or puerperal uterine infection.

From the obstetrical point of view, special care should be taken in making the vaginal examination. One should look for abnormalities, such as developmental defects, tumors and cysts, whose presence might complicate the delivery. The size and consistency of the uterus should be carefully noted. A uterus disproportionately large for the period of amenorrhea may indicate a hydatidiform mole. It is wise to make a smear of the cervical secretions at this time, and examine for gonococci. Although it is best to make a complete examination as early in pregnancy as possible, it is often wise not to make the vaginal examination at the first visit. Some women are nervous and excitable and may have a very disagreeable reaction to such a procedure. However, there is never any excuse for completely neglecting vaginal examination. An explanation of its importance will invariably do away with any objection which might be raised. The vaginal examination should be repeated about six weeks before term to check local conditions.

External pelvic measurements should be taken, but are inexact at best, and serve only as suggestive information. Too often "contracted pelvis" has been diagnosed on the basis of the external measurements alone and cesarean section performed. Not infrequently small external measurements are associated with a normal sized pelvis internally. On the contrary, normal external measurements are no guarantee that the pelvis is normal internally. Therefore, the pelvis should be measured internally as well. The diagonal conjugate is the most important single measurement practicable for the majority of patients. It is best taken after the fourth month when the uterus has risen out of the pelvis. If over 11.5 cm. it indicates a normal sized pelvic inlet. The intertuberous measurement gives an adequate idea of the pelvic outlet. If this measurement is over 8 cm. the outlet may usually be considered large enough. *X*-ray pelvimetry may be of great value if there is doubt regarding the roominess of the pelvis but as yet is too expensive for routine use in private practice. It must not be forgotten that the value of exact measurements is

relative only. The possibility of delivery by the vaginal route depends not so much upon the exact measurements of the pelvis as it does upon *the relation* of the fetal head to the pelvic inlet at term, the position of the head, and the type of uterine contractions.

Laboratory examinations which should be made are the Wassermann test, a complete urine examination and blood count. Reasons for these tests will be commented upon in more detail in the later sections.

ROUTINE ADVICE: FOLLOW-UP EXAMINATIONS

In general, if a woman is physically sound, her routine of life should be upset as little as possible except for specific advice as embodied in the paragraphs to follow. The patient should be warned of the appearance of dangerous symptoms, such as bleeding, excessive vomiting, visual disturbances and headache, marked swelling, especially of face and hands. She should be told to call her doctor at once concerning the appearance of any of these symptoms, and of anything else which seems to her unusual. Routine follow-up examinations should be made once a month for the first seven months, every two weeks thereafter, until the last month when the patient should be seen weekly. A fresh specimen of urine should be brought each time and examined for albumin. A printed form with instructions regarding unfavorable symptoms and what to do about them, diet, exercise, baths, etc., is a convenient manner of keeping important information at your patient's hand.

At each follow-up visit, the patient should be weighed, the blood pressure taken, the urine tested for albumin, a search made for edema and the abdomen palpated to determine the size of the fetus, position, engagement, etc. The location and rate of the fetal heart beat should be determined. As term is approached, the relation of the fetal head to the pelvic inlet becomes especially important. If engagement does not exist, attempt should be made to determine whether or not disproportion is responsible. If true disproportion exists, cesarean section is usually indicated. During the last month, if the fetus presents by the breech, attempt should be made to turn it to a cephalic presentation since the latter entails a much lower fetal mortality. So far as is known, external version is a harmless procedure.

SPECIAL CONSIDERATIONS

DIET. The fetus is a parasite and obtains its nourishment from maternal tissues. As long as the placenta is not impaired by disease or senility, it will take from the mother those substances which are necessary for fetal nutrition and growth. With the exception of the vitamins, stores of which become rather rapidly depleted, sufficient amounts of the basic food substances exist in the maternal organism to insure adequate fetal nutrition regardless of the state of maternal nutrition. Therefore, the fetus is only indirectly affected by the mother's diet. However, the fetal drain is a continuous and ever increasing one, and the mother must ingest a sufficient amount and variety of foods to replace the elements used up by herself as well as those withdrawn by the fetus, if her tissues are to remain healthy and undamaged by the pregnancy.

Ordinarily speaking the average American diet contains a sufficient variety and quantity of foods to take care of maternal needs, and need be changed only in so far as a specific deficiency may exist. A certain amount of protein is necessary to maintain the proper nitrogen balance; in general animal proteins are best and should constitute at least one-half of the protein intake. One serving of meat a day suffices to meet this requirement satisfactorily. Toward the end of pregnancy when toxemia is most likely to develop, it is felt by many authorities that protein is detrimental, therefore it is probably wise to restrict meat to once a week or omit it entirely during the last month. The amount of fat and carbohydrate desirable depends upon the individual and her activities. A sufficient quantity to bring the daily caloric intake to 2000–2500 is usually safe. Weight gain is a satisfactory method of judging whether one's patient is getting too much

or too little. Weight should remain almost constant for the first few months; thereafter, a gain of two to three pounds a month is to be expected. Excessive gain should be curbed by limitation in the quantity of fat and starch consumed.

Vitamins are all important for both mother and fetus. Vegetables, particularly the leafy ones, fruits, eggs and milk together contain all of the important vitamins and should be included in the daily ration. Good sources of the various vitamins can be found in any diet manual and need not be detailed here. The amount of vitamin D contained in the ordinary dietary may be insufficient, therefore it is wise to add cod-liver oil, irradiated ergosterol or other substances containing large amounts of this substance. The effects of vitamin deficiency upon the human fetus are still largely theoretical, but animal experiments have yielded much suggestive evidence that various organ defects and other abnormalities may result. For proper maternal metabolism the vitamins are known to be of utmost importance, both during pregnancy and lactation.

Certain minerals are necessary, such as calcium, phosphorus, iron and iodine. The proper retention of these substances is not well understood, but it is known that calcium and phosphorus are best retained only when adequate amounts of the vitamins are ingested. To insure a sufficient amount of calcium, one quart of milk a day should be taken. If this is impossible or inadvisable, calcium and phosphorus may be given as dicalcium phosphate. If adequate amounts of calcium are not taken, the maternal bones may be depleted of their stores.

Fluid is necessary to maintain a proper water balance and should be taken in the amount of eight to ten glasses a day.

Palatability and variety are important also, but as one may see by perusing any diet manual, it is not difficult to make one's diet conform to the requirements outlined and have it varied and palatable in addition.

BOWELS. Constipation is a very common and undesirable associate of pregnancy. The bowels should move once daily. A diet containing adequate quantities of roughage plus daily exercise assists greatly in producing the desired result without the aid of medication. Should these prove insufficient, however, proper medication should be prescribed. Mineral oil usually proves satisfactory and is superior to the cathartics since it is merely a lubricant, does not irritate the bowel nor cause violent peristalsis. If constipation persists in spite of these measures, the addition of the milder laxatives such as milk of magnesia or phenolphthalein, should be tried first. Violent peristalsis is undesirable, as it may initiate uterine contractions.

EXERCISE. Every pregnant woman should arrange to get a certain amount of exercise daily. The advantages need not be detailed since they are obvious. All forms of violent exercise, such as tennis, climbing or horseback riding should be interdicted, since they may produce abortion. Walking is the best form of exercise for the gravida, not strolling nor windowshopping, but brisk walking, the amount depending upon the patient. Four or five blocks and back are usually adequate. Swimming is permissible up to the seventh month, but should consist of paddling around rather than strenuous stroking. Golf is not contraindicated, provided it does not tire the patient. Light housework is permissible and desirable, as it serves to keep the mind occupied; however, no heavy lifting nor strenuous cleaning should be attempted. Automobile riding, except for short jaunts over smooth roads, is undesirable. In short the more violent activities may cause abortion or premature labor and should be avoided.

REST. Particular pains should be taken by the gravida not to tire herself. Late hours are poor preparation. In addition to the customary sleep period, an afternoon rest of one-half hour to an hour is advisable. This is especially desirable in the late months. Sometimes pregnant women experience difficulty in sleeping, particularly in the latter half of pregnancy, being disturbed by abdominal bulk and the activity of the fetus. In such circumstances, a mild

sleeping potion is not contraindicated. The barbiturates are useful for this purpose.

BATHING. Cleanliness is a virtue under any and all circumstances. There is no rational objection to tub baths except in the last month. It becomes unwise then because bath water may get into the vagina and be a potential source of infection should labor supervene unexpectedly. At this late period, showering or sponge bathing is preferable.

SEXUAL INTERCOURSE. Intercourse should be indulged in in moderation and should not be practiced during the last six weeks since it, too, may be a potential source of infection should labor follow soon after. We have seen several cases of puerperal infection in which there was a history of intercourse shortly before the onset of labor. Intercourse should not be resumed again for six weeks following delivery. When considerable abdominal enlargement exists, care should be taken by the husband not to bear too much weight on the abdomen.

ALCOHOL AND TOBACCO. Drinking and smoking have become almost integral parts of modern civilization. Although completely banned by some authorities, if practiced in moderation they are productive of no harm to the fetus so far as is known. Campbell[1] canvassed a large number of the country's leading obstetricians regarding the question of smoking. The majority opinion was to the effect that smoking leads to nervousness, respiratory and gastrointestinal upsets and is, therefore, inadvisable except in extreme moderation, say six to ten cigarettes a day. Animal experimentation seems to indicate direct effects of nicotine upon ovaries and uterus, which may lead to relative sterility and the birth of unhealthy young. Alcohol should be restricted to light wines and beer. Occasional indulgence in a glass or two with dinner is certainly productive of no significant harm.

RECREATION. Relaxation and recreation are important factors in life and should be sought by the gravida in a moderate way. The theatre, cards, even dancing, serve not only to amuse but also to keep the mind off the minor discomforts and annoyances of pregnancy.

CLOTHING. Modern dress is sensible and suited to pregnancy. Abdominal compression by girdles or corsets, except those designed for the purpose, should be avoided. The wrap-around type of dress which can be easily adjusted to any degree of abdominal enlargement is eminently suited to the latter months of pregnancy. The breasts, which become larger and heavier should be supported by an uplift type of brassiere. This aids in preventing subsequent sagging. Round elastic garters should be avoided because they, as well as the pregnancy, tend to impede the return of blood from the feet and legs, thus favoring the development of varicose veins. The most suitable type of shoe will depend upon the individual, but in general, the extremes are bad. Both very high heels and no heels are likely to result in backache. Shoes which give support to the arches and possess a moderate heel of the Cuban type are the most satisfactory. Bedroom slippers should never be worn except for their specific purposes.

BREASTS. In addition to the use of an uplift brassiere, the breasts require further care. During the last few months for five to ten minutes every evening, it is wise to anoint the nipples with a bland oil or cream and gently pull the nipples outward. This assists in counteracting inversion tendencies, and makes the skin more pliable, less likely to crack or become sore when nursing is begun.

ABDOMEN. In many women the skin of the abdomen "cracks," becomes striated and disfigured probably because of the rapid stretching. Some skins are more susceptible to this than others. We feel that massage of the abdominal skin daily during the last three months with oil or cream helps to prevent striae. A further aid is the maternity corset which gives an uplift support to the abdomen. This also helps to prevent diastasis of the rectus muscles and the backache which often develops as the abdomen protrudes more and more, throwing the gravida slightly off balance. Such corsets are not very expensive. Most women are only too glad to stand the

expense when the reasons for their use are explained. No woman wishes to lose her figure.

TEETH. The condition and care of the teeth are very important in pregnancy. Root abscesses may act as foci of infection which may later be responsible for urinary or puerperal infection, or possibly act as a precipitating cause of pregnancy toxemia. Consequently, thorough dental examination and care are essential unless the teeth are in excellent condition or have recently received attention. Pregnancy is rarely a contraindication to dental treatment. At one time it was held that pregnant women were prone to dental decay, the theory being that the calcium demands of the fetus resulted in decalcification of maternal teeth. In recent years considerable doubt has been cast upon this belief. Mull, Bill and Kinney[2] studied the variations in serum calcium and phosphorus during pregnancy and could establish no relationship with the condition of the teeth. They observed changes in the teeth during pregnancy in a small percentage of cases only and felt that this was no greater than would probably occur in a similar group of non-pregnant women during the same period of time. However, it still remains important for expectant mothers to ingest sufficient quantities of calcium to make depletion of her own calcium stores unnecessary. In addition, it is well for her to pay special attention to local mouth hygiene, brushing her teeth regularly, briskly and often.

WEIGHT IN PREGNANCY. It is important to follow the weight throughout pregnancy for two reasons: (1) Excessive gain in weight during pregnancy due to fat is difficult to lose later, while timely dieting is usually effective in prevention. The total gain should rarely be more than twenty to twenty-five pounds. (2) Sudden large gains in weight especially during the late months often indicate occult edema and thus point to a developing toxemia. If not combined with albuminuria and hypertension, it is often sufficient to prescribe more rest, limited fluids (less than a quart a day), and epsom salts daily, or every few days depending upon circumstances. Pounds may be lost rapidly in this manner.

The idea that one can influence the size of a baby by ordinary variations in the maternal diet is probably unfounded. It has been tried many times without success. Babies of diabetic mothers, however, are likely to be larger than normal, but whether the increase in maternal blood sugar is specifically related or not is unknown.

COMPLICATIONS PECULIAR TO PREGNANCY

NAUSEA AND VOMITING. Varying degrees of nausea and vomiting are experienced in the early months by approximately 50 per cent of pregnant women. While usually worse in the morning, the nausea may appear at any time. Most authorities believe that this represents a true toxemia of pregnancy, but all agree that there is a large psychic element. After three months the nausea and vomiting usually cease spontaneously. In most women, the condition amounts to an annoyance only. However, and this is a danger which the attendant must keep clearly in mind, the vomiting occasionally becomes severe and persistent, resulting in dehydration, loss of chlorides, malnutrition and ketosis. In this event, the patient should be hospitalized at once and treated along the well established lines. For the usual case in which the patient vomits only occasionally, experiences no significant loss of food nor upset in her metabolic processes, various minor remedies may be used. A dry cracker by the bedside to be eaten immediately upon awakening, before brushing the teeth or making the toilet, often suffices. Whatever the remedy, it should be suggested in a confident manner, the psychic element being a large one. Some employ various glandular compounds by hypodermic with success. This again is probably of more psychic value than anything else. In general, solid, dry food taken in small quantities at regular, frequent intervals favors retention.

BLEEDING. Patients should be warned to notify their doctor at once should vaginal bleeding occur. In the early months, vaginal bleeding may indicate impending

abortion, which can sometimes be averted by bed rest and morphine. In the latter months, bleeding means either premature separation of the normally implanted placenta or placenta previa. Both conditions demand hospitalization. An exact diagnosis should never be attempted in the home since vaginal examination is the only method of making an accurate diagnosis, and vaginal examination may initiate further hemorrhage. It is never permissible to make a vaginal examination in cases of bleeding unless sterile preparations have been made and adequate equipment is at hand for treating whatever condition may be found. Thus, the patient should be in an operating room set up for the introduction of a hydrostatic bag, or for cesarean section, the patient's blood should be typed and a suitable donor should be at hand. If the bleeding is very small in amount, it may be sufficient to bed the patient at home and watch her for a short time. Occasionally, a small showing of this kind comes, goes, and does not recur, without benefit of treatment.

TOXEMIA. As pregnancy progresses, the kidney function may begin to show signs of insufficiency, either because of a previous nephritis or because of toxemia of pregnancy. These conditions give rise to certain signs and symptoms for which both patient and doctor must be on the lookout. Sudden weight gain, indicating an occult edema, rise in blood pressure, appearance of albumin in the urine, swelling of the face and hands, persistent headache, dizziness, blurring of vision, epigastric pain, are all suggestive singly and in combination. A systolic pressure of 140 or over, or a diastolic pressure over 90 should be regarded with suspicion. The early recognition of these conditions with proper treatment, usually in the hospital, often results in the avoidance of serious consequences for the mother, the child, or both.

COMPLICATIONS HAVING A SPECIAL RELATION TO PREGNANCY

SYPHILIS. While syphilis complicating pregnancy is not seen frequently in private practice, a Wassermann test should always be made to rule it out. No other method is satisfactory since the disease is notoriously silent in women. The results of energetic treatment are very good. The reports of McKelvey and Turner,[3] and McCord[4] picture very well what can be accomplished. The earlier the treatment is started, the better the results. Ninety-five per cent of those receiving good treatment deliver healthy babies. Children born of syphilitic mothers should be examined and watched carefully for signs of congenital syphilis. Even with good treatment, a small percentage of the children will be affected. Preferably the treatment should be administered by a syphilologist.

GONORRHEA. A smear of the cervical secretions should be made whenever there is a history suggestive of gonorrhea or whenever the character of the cervical secretion is suspicious. Repeated examination may be necessary. Should gonococci be found, local treatment is indicated. It is pretty well recognized, however, that gonorrhea is a self-limited disease, that the value of antiseptic instillations, etc., is of questionable value. All that one can hope to do is to promote cleanliness, combat contagion, and suppress excessive discharge. For this purpose, a douche of potassium permanganate, 1:8000, is useful. Swabbing the vagina and cervix with mercurochrome is probably harmless and may be of value. These measures at least have the value of keeping the patient attentive to the infectiousness of her condition and yet comforting her in the belief that something is being done for the disease. Sometimes the condition goes unrecognized until some days after delivery when a gonococcal puerperal infection results.

The danger of gonococcal ophthalmia of the newborn is well recognized. Since not all cases of maternal gonorrhea can be recognized, the Credé technique of instilling silver nitrate into the conjunctival sacs of all newborn should be carried out as a routine. It prevents the development of the ophthalmitis in a high percentage of cases. Indeed, it is unlawful not to do so in many states.

PYELITIS. Quite frequently pyelitis develops during pregnancy. It has been shown

that dilatation of the ureters and of the kidney pelves occurs practically invariably in pregnancy. The etiology of this dilatation is in doubt. The enlarging uterus has been incriminated, but since ureteral dilatation is not caused by tumors much larger than the pregnant uterus even at term, this hardly seems a satisfactory explanation. In 1928 Hofbauer[5] described hypertrophy of the ureteral musculature which narrowed the lumina in the lower third and felt that this might be the responsible factor. Quite probably it does contribute to the etiology. His explanation has been criticized because the dilatation is usually more pronounced on the right side whereas, if Hofbauer's explanation were correct, the dilatation should be equal. More recently, Traut and McLane[6] have attributed the dilatation to atonia of the ureteral musculature. Whatever the explanation, this dilatation results in a relative stasis which favors the development of urinary tract infection. The complication is right sided more often than left sided, as is the ureteral dilation. The colon bacillus is the most frequent organism involved. Conservative treatment is satisfactory in most instances. This consists of bed rest, high fluid intake, alternate periods of alkalinization and acidification, in conjunction with the use of urinary antiseptics. Occasionally catheter drainage of the kidney pelves is necessary. Rarely the infection is so severe that it results in, or demands, abortion.

ANEMIA. A blood count should always be taken. Comparatively low hemoglobin readings are obtained in a high percentage of pregnant women. Sometimes this represents a true anemia of the hypochromic type and should be treated with iron. Whether such anemias actually are due to the pregnancy or are aggravated by it is questionable. In any event they are usually not serious. Adequate diet is the best preventive measure. Often the lowered hemoglobin is due to hydremia, which increases as term is approached, and disappears soon after delivery. Adair, Dieckmann and Grant[7] have recently shown that considerable variation in hemoglobin occurs normally, so that all low figures do not represent true anemias. Variation of this kind is uninfluenced by treatment, indeed, it requires no treatment. Rarely anemia of the primary type, a macrocytic anemia, with high color index, is encountered, apparently specifically though obscurely related to the pregnancy. Treatment is that of pernicious anemia. If severe, or unresponsive, abortion may result or be demanded.

MINOR CONDITIONS

VARICOSE VEINS. Engorgement of the veins of the lower extremities is bound to exist in pregnancy because of uterine pressure and pelvic engorgement. Not infrequently true varicosities exist, particularly in women who have had several children. These often prove very uncomfortable. The etiology of this complication is not definitely known. Some believe that there is an endocrine factor. A semielastic bandage assists in allaying the discomfort and in preventing further dilatation. Varicosities of the vulva sometimes develop. There is no very satisfactory method of combating this complication except to remain off the feet as much as possible. Varicosities have been injected with sclerosing solutions during pregnancy with impunity and satisfactory results. Nicholas[8] recently reported satisfactory results in 100 patients injected at all stages of pregnancy, some of them many times. There were no serious complications. However, the procedure may be dangerous and, therefore, is not advised. Furthermore, varicosities disappear in large measure at the termination of pregnancy.

"HEARTBURN." A common complaint is "heartburn," or the regurgitation of acid stomach contents into the esophagus. This is due to the increasing pressure upon the stomach as the uterus pushes upward. It is best relieved by soda and sips of milk.

MUSCLE CRAMPS. Cramps in the leg muscles, especially at night, may prove very distressing. This may be due to calcium deficiency or to pressure upon nerves by the increased abdominal contents. The only therapy is to be certain that the calcium intake is adequate. For the immediate distress, it is advised that the

patient move around when the cramps occur.

ABDOMINAL PAINS. Many patients complain of lower abdominal pains, especially in the latter part of pregnancy. Sometimes these are due to actual uterine contractions and sometimes to the increasing stretch of uterine and abdominal walls. For the former, reassurance is the only measure possible, for the latter, a proper maternity corset is of value.

MEDICAL AND SURGICAL COMPLICATIONS

It is not within the scope of this paper to deal with the various medical and surgical complications of pregnancy. When tuberculosis, heart disease, diabetes or hyperthyroidism, for example, coexist with pregnancy, they constitute situations which are best handled by the cooperative efforts of the obstetrician and the internist. Early diagnosis is imperative since in many instances the continuance of the pregnancy may seriously endanger the patient's life. Generally speaking, however, the complicating disease should be treated as such, though of course special problems arise regarding the conduct of the pregnancy and labor.

SUMMARY

Prenatal care is an essential feature of good obstetrical care. If one wishes to convince himself of the value of prenatal care by cold, hard figures he need only consult the reports of maternal mortality in Philadelphia (1931–1933),[9] the Fifteen States report,[10] and others of similar nature. All show that maternal deaths are associated with inadequate or no antenatal care in a large percentage of the cases. Having consulted her physician and being willing to cooperate, the patient has done her part, in a manner of speaking. It is then up to the physician to see that she gets the benefit of proper examination and care according to the principles set forth.

Proper prenatal care involves:

1. Medical care from a very early period of pregnancy, in case continuance of the pregnancy is inadvisable;

2. Complete history and physical examination, both general and obstetrical, in order that the patient's physical status may be fully appreciated, and in order that the development of abnormalities may be anticipated as much as possible;

3. Acquaintance of the patient with the danger signals, in order that she may call her doctor at once;

4. Instruction of the patient regarding the proper regulation of diet, exercise, rest, bowels, sexual intercourse, and general mode of living;

5. Regular follow-up examinations becoming more frequent as term is approached, in order that the physician may discover deviations from the normal as early as possible;

6. Appreciation of the complications which are more or less closely related to pregnancy, their suggestive symptoms, methods of diagnosis, in order that they may be forestalled or treated in their very early stages. The complications referred to are syphilis, gonorrhea, pyelitis, hyperemesis, the late toxemias of pregnancy and hemorrhage, particularly.

7. Knowledge of the minor complications and what may be done for them.

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PREPARATION OF PATIENT FOR DELIVERY

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YEAR in and year out the puerperal death rate in America as well as in all other countries remains lamentably high, with septic infection, toxemia and hemorrhage as the chief causative factors. The death rate from septic infection has followed an uninterrupted course for the past two decades or more.

Far more important than the cure of sepsis is its prevention. This condition is largely preventable and prevention is provided by following the simple rules of preparation herewith outlined. The labor itself must be viewed as a surgical procedure, and accordingly it must be supervised on the most rigorous surgical lines.

Like all important and serious operations, the obstetric delivery requires careful preparation on the part of the patient, the physician, the nurses and the environment in which the delivery is to take place. Success or failure in the presence of sudden and unexpected complications often depends upon the thoroughness with which these preliminaries have been observed.

A most important feature of the preparation of the patient is that which has to do with proper antenatal care. Preparation for delivery in reality begins when the patient makes her first visit to the doctor. It then becomes encumbent upon him to give special antenatal supervision of the cervix, vagina and external genitalia in order to guard against possible infection following delivery.

Infection of Bartholin's gland due to the gonococcus or other microorganisms occasionally appears as a complication of pregnancy and of labor and may be the source of a generalized sepsis. A vaginal examination during the course of labor in the presence of serious infection lurking at the entrance of the birth canal may cause fatal septicemia. Every effort, therefore, should be made to rid the patient of all evidence of infection of the external genitalia as soon as the patient registers for delivery.

Inflammation of the vagina should be treated by copious irrigation with 1 per cent Lugol's solution in warm water, two or three times daily. Simply keeping the external genitals clean by washing with tincture of green soap and warm water twice daily and a mechanical flushing of the vaginal wall with an alkaline douche twice daily will prove of great service. In patients approaching term, vaginal douches and local medication should be discontinued.

A common cause of inflammation of the vagina and of leucorrheal discharge during pregnancy is the trichomonas vaginalis. Infestation with the organism was found in one-fourth of a series of pregnant women in the Antenatal Clinic of the Jefferson Medical College Hospital.

The treatment consists in thoroughly drying the vagina followed by insufflation with aldarsone powder.

Inflammation of the cervix is often accompanied by organisms of the pyogenic type, although occasionally, the gonococcus may be found. Topical applications two or three times weekly may be made with 25 per cent argyrol, tincture of iodine or 50 per cent silver nitrate solution. In obdurate cases the electric cautery may be employed. As the patient nears term vaginal douches should be discontinued as this favors contamination and alters the chemical reaction of the vaginal secretion. A normal vaginal secretion is strongly antagonistic to pathogenic bacteria.

The practice of indiscriminate vaginal examination in patients approaching or

near full term is not without danger of infection, and for this reason should not be performed after the thirty-fourth or thirty-sixth week. After this period, examination should be made through the rectal canal.

When labor pains begin the patient is prepared for delivery.

The patient's hips are elevated on a bed pan. A sterile cotton sponge moistened with lysol is inserted in the introitus to prevent the entrance of infective material and the adjacent parts are saturated with a solution of green soap and lysol. The pubic and vulvar hair is then shaved from above downward. Following this the pubis, vulva, perineum and inner margins of the thighs are thoroughly scrubbed with a solution of green soap and lysol, using strips of sterile gauze. A sterile dressing is then placed over the vulva.

It is not always necessary to employ an enema at the onset of labor; if the rectum is empty none need be given, but if it is distended with fecal material, a low enema should be administered before the perineum and vulva are prepared.

Final preparations for delivery in multiparous patients are made when the pains become of a bearing down character. In a primigravidous patient the final preparations for delivery are made when bulging of the perineum is noted. The final preparations for delivery include the preparation of the physician's person, the antiseptic preparation of the vulva and the draping of the patient with sterile materials.

The preparation of the hands of the operator, assistants and nurses as well as all others intimately concerned in the technical work of all deliveries should be performed as follows:

The outer clothing and shoes should be removed and replaced by an operating shirt, trousers and shoes. The hands must then be scrubbed with brush and green soap for ten minutes, preferably in running water. The scrubbing is repeated using a second brush for five minutes. The hands and forearms should then be immersed in 70 per cent alcohol solution for three minutes.

Immediately before delivery the surfaces of the vulva, the vaginal canal, lower abdominal wall and inner side of the thighs, as well as the vaginal canal, are washed with warm tincture of green soap and 1 per cent lysol solution. This initial cleansing is to be followed by washing the parts with 70 per cent alcohol and finally by painting the vulvar surfaces with a 3 per cent solution of tincture of iodine.

Catheterization of the bladder is now performed as follows: The external meatus is swabbed with a 10 per cent argyrol emulsion. A sterile glass or soft rubber catheter is dipped in a 10 per cent argyrol emulsion and then inserted in the bladder. After withdrawing the catheter the meatus is again cleansed with warm lysol or alcohol solution.

The delivery field is then isolated by surrounding the patient with sheets and leg covers or a special delivery sheet.

CONCLUSION

To the obstetrician no complication arising after delivery is more disquieting than infection.

In the preventive regime a long list of factors must be considered. Locally the most important feature is an assured aseptic ritual during the last few weeks or days of the antenatal period and especially during labor.

CONDUCT OF FIRST STAGE OF LABOR*

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THE care of the pregnant woman during the first stage of labor may be considered as the last and most important portion of antepartum care. In the woman who has been under observation, many important general and local observations have been recorded. It is not necessary to note them again. The woman has been brought to the end of her pregnancy in the best possible general condition and the relation of the fetal size to the pelvic capacity has been noted. The end toward which all this work has been directed has arrived. The physician must now maintain the physical and mental status of his patient during labor and must take measures to avoid the complications of delivery and the puerperium. On the other hand, when the woman is seen for the first time by the physician at the beginning of labor it is necessary to carry out all the observations usually spread over the long period of prenatal observation. Her general condition may or may not be as good as it might have been if she had been under observation during her pregnancy. In the latter instance an attempt to set down the proper care during the first stage of labor would involve a discussion of many measures such as general physical examination, pelvimetry and blood examination, which ordinarily would be done in the antepartum period. It is customary in a consideration of this subject to include a list of the materials and instruments necessary to conduct labor and delivery in the home, but such a list may be obtained from any standard textbook.[1] This discussion of care during the first stage of labor will be devoted to general principles, which should be uniform regardless of whether the patient is delivered at home or in the hospital. Furthermore, it will presume that the patient has been under medical supervision during the antepartum period and has begun labor with no anticipated complications. This will eliminate from this discussion all measures which properly should be carried out in the antepartum period, and also those cases which might be considered under the head of abnormal labor.

In the normal woman the condition of the cervix at the onset of labor is of primary importance in considering the first stage of labor. In many women marked changes occur in the cervix during the last month of pregnancy. In the primiparous patient these are often, but not always, accompanied by the subjective symptom of "lightening" and the objective finding of engagement of the fetal head. In the multiparous patient these changes in the cervix are also present, but engagement often does not take place until the onset of labor. While the failure of engagement in the primiparous patient before the onset of labor should make the careful obstetrician reconsider his estimate of fetal size and pelvic capacity, this failure is often found to be of no significance. In a fair proportion of normal primiparous women the head descends rapidly during the first stage of labor, engaging for the first time. Regardless of engagement the changes noted in the cervix during the last three or four weeks of pregnancy consist of a gradual retraction and thinning of the structure. The cervical canal becomes obliterated. The rigid cervix of early

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pregnancy may become soft and dilatable. Finally, partial dilatation may occur even up to 2 or 3 cm. Careful examinations during the last four weeks of pregnancy will reveal some or all of these changes in a large proportion of patients. Their cause remains unknown, as does the mechanism concerned with the onset of labor. Some of these patients begin labor with half, a few with nearly all of the changes necessary for the termination of the first stage of labor. Activity on the part of the patient does not seem to be a marked factor since this favorable condition of the soft parts is often observed in cardiacs who have been bedridden for months. Such changes, according to their degree, form a basis for predicting the duration of the first stage of labor in the normal woman.

A knowledge of their character is of enormous importance in planning the delivery of the toxemic patient, or the patient suffering from a medical complication of pregnancy. The failure of the cervical changes to take place during the last month of pregnancy should make the physician suspect that there is an error in the estimated date of confinement. In most instances this will be found to be true, the patient delivering two to three weeks later than the expected date. True postmaturity rarely occurs. During this additional time the cervical changes often take place. A small proportion of women, usually primaparae, will enter labor with none of these preparatory changes accomplished. The cervix is long, firm, and closed with no obliteration of the canal. Such a patient may be said to start labor at scratch. A long and protracted first stage may be expected and it should be cared for in a particular manner which will be considered later.

The actual cause of the onset of labor is unknown. It is usually announced by the occurrence of rhythmic, painful uterine contractions which gradually become stronger and decrease their interval. They are accompanied by a progressive change in the cervix. The patient describes these early pains as being similar to menstrual cramp, being felt chiefly in the sacral region and radiating forward and down the anterior aspects of the upper thighs. Signs of impending labor may be listed as follows: (1) A loss of weight of from one to three pounds occurs rather consistently in the last week or ten days of pregnancy; (2) the cervical changes previously described; (3) the occurrence of a slight bloody discharge near the estimated date of confinement. This is of special significance if advanced cervical changes are present since such patients may deliver with extraordinary rapidity; (4) the occurrence of rupture of the amniotic sac. This event is usually followed closely by the onset of true labor if marked cervical changes are present. If they are not, several days may elapse before labor begins spontaneously. It is unwise to stimulate labor in the latter type of case since as a rule it will be shorter and easier in the normal woman if allowed to come on spontaneously.

While all such patients should be hospitalized, rectal and vaginal examinations should not be performed on the patient with ruptured membranes until the onset of labor since such investigations only serve to carry infection into the amniotic sac. Infection appears to occur spontaneously in these cases after the onset of labor and in its conduct it becomes necessary to carry out rectal or vaginal examinations, but these should be restricted to a minimum.

The patient should be informed concerning the characteristics of the onset of labor and of those signs which more or less immediately precede labor. She should be warned of the importance of immediately reporting any bloody discharge or the persistent leakage of fluid to her physician. False labor may occur during the last month, the normal contractions of the pregnant uterus becoming definitely painful. As a rule this phenomenon may be distinguished from true labor on the following points: (1) The patient describes the pain as in the front of the abdomen and not in the back; (2) the interval is irregular

and does not tend to decrease; (3) the contractions do not get progressively stronger; (4) these painful contractions are more noticeable when standing and tend to disappear when the patient lies down; (5) they are not accompanied by any changes in the cervix; (6) they may be quickly abolished by morphine grain ⅙ given hypodermically. The occurrence of such pains may be ignored in the patient whose cervix is not yet prepared for labor. They should be investigated as soon as possible in the patient whose cervix shows marked changes. Occasionally false labor may be a very troublesome complication. One patient who had intermittent painful contractions preventing sleep for a month before the actual onset of labor, required hospitalization and heavy sedation to secure sleep.

Some women become incontinent during the last month. The patient may mistake this symptom for rupture of the amniotic sac. This leakage only occurs at long intervals and has a definite urinous odor as compared to the characteristic odor of amniotic fluid. Berlind[2] has suggested that the normal acid reaction of the vagina might be changed by the leakage of alkaline amniotic fluid, and that this altered reaction as denoted by the change in color from orange to green in filter paper soaked in brom-thymol blue might be useful in dealing with doubtful cases of amniotic rupture.

Having determined that the patient is actually in labor one may consider the management of the first stage under the following heads: (1) general precautions against sepsis; (2) the initial examination of the patient; (3) the preparation of the patient; (4) observation of the progress of labor; (5) diet and fluid intake; (6) indications and technique for vaginal or rectal examinations; (7) a consideration of drugs which relieve pain.

Before considering the conduct of labor, it is important to recall the relationship of sepsis to the first stage. The overwhelming evidence at the present time is to the effect that in the exogenous type of puerperal sepsis the infecting organism is, in the great majority of instances, introduced during labor. In a few instances such an organism may be acquired a few days before labor begins. The most frequent infecting agent, the hemolytic streptococcus, is introduced to the patient from her environment or, directly or indirectly, by one of her attendants. It is important to warn the pregnant woman to avoid all individuals with proved or suspected hemolytic streptococcus infections during the last month of her pregnancy. If such individuals exist in her household she should be strictly separated from them. White[3] has recently shown that living and virulent organisms can be recovered from the dust of the sick room. Such conditions must be the cause of some of our puerperal hemolytic streptococcus infections. A few years ago a case was seen by the author in which this was almost certainly the cause.

Following the onset of labor it is advisable to limit the number of individuals present in the patient's room to the smallest possible number. B. P. Watson has shown at the Sloane Hospital the amazing number of contacts made by women in labor. The more that this is cut down, the more the possible sources of exogenous infection are cut off. This is especially true during the winter and early spring months when carriers of this organism become very common. Routine nose and throat cultures have been performed on the attendants of the obstetrical service at Bellevue Hospital for the past four years and show a rise in hemolytic streptococcus carriers from about 1 per cent in October to from 10 per cent to 20 per cent in February. The prevalence of hemolytic streptococcus in the nose and throat should make it obvious that all individuals, both nurses and doctors, who treat or examine a woman in labor should be masked. The mask should cover both nose and mouth and should consist of at least four thicknesses of gauze. Holland states that the mask at present highly approved in Great Britain

has in addition a layer of wax paper. This should further diminish the danger of droplet spread of infection. The individual with an acute upper respiratory infection or with an acute infection about the hands should be rigidly excluded from contact with the patient in labor. Such individuals should not be allowed to return to their duties until the infection has disappeared and check-up cultures show the absence or marked diminution of hemolytic streptococcus. Doctors or nurses continuing the care of labor patients under such circumstances are taking a great risk with the welfare of the patient.

Colebrook[4] has been able to isolate streptococci from the hands of a small percentage of pregnant women and feels that this may be a source of puerperal infection. The patient must be warned against the risks of handling herself during labor. The nurse should be instructed to guard against this if the patient becomes unmanageable. It might be stated that it is almost impossible to prevent this type of contamination when deep analgesia is used during labor, because the patient can no longer control herself. It should be emphasized that the separation of obstetrical patients from the general medical and surgical patients is of obvious importance. The isolation of all patients showing a febrile puerperium should be strictly carried out.

The organisms causing infections of the endogenous type are probably present in the genital tract of all pregnant women. The anaerobic streptococcus is the most frequent of these bacteria to become pathogenic. They become virulent and invasive as a rule when some factor such as anemia, hemorrhage, toxemia, exhaustion, excessive trauma, instrumentation, and occasionally amniotic sac infection is present in the pregnant woman. Their prevention is related to the elimination of these factors. It is obvious therefore that this type of infection cannot always be avoided. On the other hand infection of the exogenous type can and should be reduced to a minimum since we can, in most cases, control the source. Following this brief and inadequate consideration of the relationship of sepsis to the first stage of labor, the care of the woman in labor can be discussed.

Having determined that the patient is actually in labor, certain observations should be routinely carried out. It is not necessary to perform a complete physical examination on the patient who has been under careful antepartum observation, nevertheless, the temperature and pulse should always be noted. In the event that fever is present, a careful search should be made for its cause. The blood pressure should be taken and this observation repeated at least every six to eight hours during labor. If any elevation of the systolic or diastolic pressures is noted readings should be performed more frequently. A specimen of urine should be secured and examined for albumin, and if it is present early in labor a second specimen should be examined later if labor is prolonged.

An abdominal examination reveals all the necessary facts in most cases of early labor. It is important to note the character of the abdominal wall since this is of importance in the second stage. The size of the uterus should be noted, excessive enlargement suggesting twins or hydramnios; a small uterus suggesting prematurity. The shape of the uterus is of importance, a broad short uterus suggesting a transverse presentation. The axis of the uterus should be observed and is of importance if deviations from the midline occur. Such deviations may be corrected by binders such as have been devised by Beck. The frequency, intensity and duration of the uterine contractions should be carefully observed. The presentation and position of the fetus should be noted. The upper pole is first palpated, determining whether it is breech or a vertex. Pressure upon the upper pole with one hand then brings the back into prominence to the other palpating hand on one side, the small parts usually being felt on the other. The presenting part may

then be palpated with both hands, again keeping the question of a breech presentation in mind. The location of the cephalic prominence in relation to the fetal back should be noted since this is an indication of the flexion or extension of the head. The depth to which the head has descended into the pelvis should be observed. Lack of engagement at the onset of labor should not be a source of worry even in the primiparous patient since this fails to occur at this time in about one-third of these cases. Even apparent over-riding often disappears as the head is flexed anteriorly and laterally and directed into the pelvic brim by the increasing uterine forces. On the other hand failure of descent and engagement to occur in the primiparous patient after strong regular pains have existed for several hours should be a source of concern and justifies the performance of a thorough vaginal examination. Stereoscopic *x*-ray studies, performed and read according to the method of Caldwell and Moloy[5] will be found to be of great value in this type of case. The fetal heart should be noted as to rate and regularity and its point of greatest intensity checked carefully in relation to the supposed position and presentation of the fetus. Failure to find the heart sounds best transmitted over the fetal back should lead to a careful check on the findings by abdominal palpation. Occasionally one cannot be certain of the presentation by abdominal examination. A vaginal examination using a strict technique to check on the abdominal findings is justifiable under such circumstances. This will occasionally result in the detection of an unsuspected breech presentation. Finally one should note carefully whether or not the amniotic sac is intact. Both history and observation of fluid leaking away with pains is of importance in making this observation.

These initial observations having been made the patient should be prepared for labor. All the pubic and genital hair should be shaved off beginning on the lower abdomen and including the anal region. While this procedure is not of marked importance in the woman who delivers spontaneously and without laceration, it is a great assistance if there are injuries to repair following delivery and a marked aid in keeping the patient clean during the postpartum stage. During shaving one should be very careful not to contaminate the vulva. Since it is very advantageous to have an empty rectum during labor, it is common practice to administer an enema following this procedure. If labor is prolonged, this should be repeated at the end of twelve hours. It is inadvisable to give a patient an enema once the second stage has begun. This procedure avoids the expulsion of fecal material when the descending part descends and presses on the rectum. It also frequently serves to stimulate the strength and frequency of the uterine contractions. The nurse carrying out these procedures should have her nose and mouth carefully masked.

Frequent observations of the patient should be made as labor progresses. These should be carried out by both the nurse and the doctor. The frequency, strength, and regularity of the pains should be noted. The rate and rhythm of the fetal heart should be carefully recorded at least every thirty minutes during the first stage of labor, being careful to make this observation between contractions. The descent of the presenting part should be followed by means of abdominal palpation. The character of the vaginal discharge should be noted, a continuous watery discharge increasing with contractions announcing the rupture of the amniotic sac; the presence of bloody mucus often suggesting that the second stage is approaching. The suprapubic region should be carefully watched for the occurrence of a distended bladder. If this is noted the patient should be encouraged to void voluntarily. Failing in this, she should be catheterized, using an aseptic technique such as will be described under vaginal examination. During the first stage all voluntary expulsive efforts on the part of the patient should be

discouraged since they only serve to exhaust her and accomplish nothing.

When contractions are noted to be frequent, strong, well sustained and regular in rhythm and it is known that the cervix is soft, retracted and partly dilated, a relatively short first stage may usually be anticipated. When the uterine contractions are widely spaced, weak, short and irregular and it is known that such cervical changes are present, the uterine forces can be stimulated by various measures. The quality of pains often improve after the routine enema which is given in early labor. Quinine hydrochloride grains 10 may be given with safety and often improves the contractions. Pituitrin should be used with great caution, an exceedingly small initial dose being used since certain patients appear to be very sensitive to this drug. Larger initial doses will sometimes produce such strong forces that in the mother extensive lacerations and rupture of the uterus will occur, as well as intracranial injury in the fetus. Pituitrin minim 1 can be given safely and if no marked effects are noted within twenty minutes, pituitrin 2 or 3 minims can be administered. Nearly always following this the uterine contractions will be found to be stronger and more efficient.

While early artificial rupture of the membranes as a means of accelerating and shortening labor has been advocated recently with a certain amount of enthusiasm, such a method should not be used routinely. It should only be applied in selected cases by individuals with considerable experience. Following this procedure, a long slow labor occasionally develops complicated by an amniotic sac infection with possible serious results for both mother and fetus. It is inadvisable to attempt to stimulate pains in the woman who commences labor with a long closed cervix and with pains of the type just described. Such patients suffer relatively little discomfort and frequently this type of contraction persists for twenty-four hours before efficient frequent pains begin. During this time the cervix retracts, softens and begins to dilate. In patients with this type of labor, it is a good thing to keep them up and about their duties. If they are planning to be delivered in a hospital it is well to postpone their admission until hard contractions begin. One should be careful to keep up their morale, particularly in the primiparous patient. Adequate sleep must be secured by the use of the milder sedatives or, if these fail, with morphine grain $\frac{1}{6}$.

One should be careful to see that the woman in early labor receives a sufficient amount of fluids and food. This can be easily carried out providing the mother is not under deep analgesia. Small feedings consisting mainly of carbohydrates with milk and soups should be given every two or three hours. In many cases, when vomiting limits the fluid intake by mouth, marked benefit to the patient occurs following the use of 1000 c.c. of 5 per cent glucose intravenously. Solid food should be stopped as the second stage approaches. It is a marked disadvantage to have a full stomach during delivery since vomiting occurs both with and without general anesthesia. Aspiration of food with serious after effects may occur during or after anesthesia.

While many labors can be followed by abdominal examinations alone, it is often necessary to gain additional facts by an internal examination, either by rectum or vagina. Rectal examination can be easily and quickly done without the extensive preparation necessary for a safe vaginal examination and therefore it is a method frequently used. It is satisfactory for ascertaining the presenting part, the degree of descent and often the position of the fetal head. The degree of dilatation and the thickness of the cervix can be made out as a rule. Because of its ease of performance this examination is often carelessly done. It is advisable to follow a definite technique. The examiner should wear cap and mask. Gloves especially kept and used for no other purpose should be employed, since

once contaminated by rectal contents they may prove difficult to sterilize. A square of sterile gauze is placed over the vulva and held in place by the thumb of the examining hand as the lubricated index finger is inserted into the rectum. The nature, position and degree of descent of the presenting part may now be ascertained. The thickness and dilatation of the cervix may be noted. The ischial spines are easily palpated. The room available to the descending head in the posterior pelvis can be more easily ascertained than by vaginal examination. The mobility of the coccyx should be noted. It is of advantage to examine during a pain since the degree and ease of descent of the presenting part during a contraction can then be determined. The examining finger may then be withdrawn and the perineum and anus are wiped from above downward with the gauze square used to cover the vulva. Skill in this type of examination can only be acquired by those doing many vaginal examinations. It is suggested that the beginner check his findings by vaginal examination by a subsequent rectal examination in order to acquire the necessary experience.

The defect of this type of examination is that it can sometimes be deceptive even to the most skillful and it is often misleading to the inexperienced. It should be emphasized, therefore, that if the physician is at all in doubt as to his findings by rectum, or if, on repeated rectal examinations, labor does not seem to be advancing normally, that the rectal examination should be checked by a vaginal examination. When the latter is performed using a proper technique, it is certainly more troublesome to the doctor but no more dangerous to the mother than a rectal examination. In order to perform a vaginal examination without endangering the patient, the physician should prepare himself as if he were about to perform a delivery. Wearing a cap and mask, he should scrub systematically and vigorously with soap and water, taking care to get between the fingers. The nails should be carefully cleaned with an orangewood stick. This should be followed by a further three minute scrub. The hands should then be dipped in 70 per cent alcohol and held in an elevated position so that excess solution runs from the fingers to the elbow. They should then be dried reserving a certain portion of the towel for the hands and others for the forearms which should be dried last. Various other antiseptic solutions may be used in a routine scrub up but these are probably unimportant as compared to the thorough use of soap and water. These antiseptic agents may even be harmful if the skin of the operator is sensitive, since it is difficult to properly scrub a skin with an acute or chronic dermatitis. Following the scrubbing and drying of the hands and forearms the examiner should put on a sterile gown and a pair of sterile gloves. Handling the latter by the turned up cuffs, he should be careful to put them on so that he does not touch the outer aspect of the glove. At Bellevue Hospital it is customary to perform this examination in the delivery room.

The patient is put on the delivery table, the lower extremities being held in the stirrups. The delivery room nurse, having scrubbed and put on sterile gloves, then washes the patient using sterile gauze, green soap and water. She first washes the external aspect of the vulva, then the lower abdomen, and inner aspect of the thighs, and finally the lower perineum and anal region. Holding the labia together to prevent contamination of the vagina the excess soapy solution is then washed off with a pitcher of sterile water. The examiner then drapes the lower abdomen and thighs with sterile towels. A sterile towel is placed under the buttocks. The labia are then held apart with the fingers of one hand, and using cotton balls soaked in 1 per cent lysol solution, the introitus is wiped carefully from above downward several times, a fresh cotton ball being used each time. Following this the examining fingers may be passed into the introitus being extremely careful not to touch the

patient at any other point. The same points may be noted, but much more clearly, as have already been enumerated under rectal examination. As a rule position can be much more easily made out, the anterior fontanelle and sagittal suture being more readily identified. The condition of the amniotic sac can be more easily made out. Prolapse of the cord is more likely to be detected. In addition it is possible to make out the character of the anterior pelvis, whether curved and roomy or angular and narrow. Following the withdrawal of the examining finger it is wise to check on the intertuberous diameter with the clenched fist. Gas anesthesia is of marked advantage in the patient who resists examination.

If catheterization is necessary, this is a very excellent opportunity, requiring only a change of gloves. In this technique the preparation of the doctor is essential. In certain institutions where the danger of infection is not so great and, possibly, in the home, the careful scrub down of the patient may be omitted. The patient may be examined in bed, after having been placed on a bed pan, and properly draped. The remainder of the technique should be carried out carefully. The discovery of any abnormality by these examinations should lead to a very careful reconsideration of the case, and in inexperienced hands, to early consultation with a competent obstetrician.

Finally, no discussion of the first stage of labor would be complete without a consideration of amnesia and analgesia. The number of agents used for this purpose have multiplied rapidly during the last few years and this may be taken as evidence that none of them are completely satisfactory. Excessive attempts to produce an absolutely painless labor may be detrimental to both mother and baby. Certain physicians with considerable skill and judgement in the use of drugs may nearly approximate this degree of perfection in obstetrical analgesia in the majority of their patients, but they have not been able to attain it in 100 per cent of cases. Furthermore their good results are obtained by marked individualization of the care of their patients. No routine formula can attain their results. While the overuse of amnesic and analgesic drugs should be criticized, and while all known methods have their disadvantage, it is necessary to acknowledge that properly used they are relatively harmless, and are of great benefit to the morale of the patient. Furthermore, in certain instances these preparations seem to shorten labor. It is important in using all of these drugs to withhold them until labor seems definitely established with hard, frequent contractions which do not diminish when the patient is recumbent. The cervix should be dilated to at least 2 cm. The only exception to this rule is in the primiparous patient with a long closed unretracted cervix. Here a prolonged first stage may be anticipated and it is important to secure rest and sleep for the patient. This can only be attained by the early administration of some drug such as morphine. In other situations the earlier use of drugs tends to produce a long slow labor. Occasionally one encounters a patient in whom attempts to relieve pain result in a marked diminution of the force and frequency of uterine contractions even when labor appears to be well established. In these cases the use of drugs should be abandoned in order to avoid a prolonged first stage. More often the converse is noted; that is labor seems to progress more rapidly after amnesic and analgesic agents have been administered. The following methods are commonly used to produce these effects during the first stage of labor:

1. *Morphine and Scopolamine.* Morphine grain $\frac{1}{6}$, and scopolamine grain $\frac{1}{500}$, are given hypodermically after labor is well established and the cervix is about 2 cm. dilated. One to two hours later scopolamine grain $\frac{1}{300}$ may be given if the condition of the patient demands it. Morphine should not be repeated unless the labor is very prolonged. When it is necessary to repeat morphine it is advisable to use grain $\frac{1}{8}$. The patient should be kept in a quiet darkened room and should be

observed continually. A certain proportion of patients will sleep deeply, arousing only for the uterine contractions. Others will obtain marked relief from pain but do not sleep. A moderate number will become restless and excited and may even require physical restraint. A minor proportion will state that little or no benefit resulted from this method. One cannot be certain of the results, no matter what the behavior is like during labor, until the patient is questioned the following day. This method should not be applied if it is felt that the second stage is imminent or that delivery will take place within two hours. If used too close to the time of delivery the baby may be born in a deeply narcotized condition and prove difficult to resuscitate. When given several hours before the second stage begins, as a rule no harmful effects are noted in the baby. While most of them appear apneic at birth it is fairly easy to establish respiration.

2. *Synergistic Analgesia (Gwathmey).* This method is also applied when labor is well established and the cervix about 2 cm. dilated. The rectum is thoroughly cleansed by means of a soapsuds enema. Morphine grain 1/6 and 2 c.c. of magnesium sulphate, 50 per cent solution, is given intramuscularly. Twenty minutes later the dose of magnesium sulphate is repeated. As soon as the sedative action begins to wear off or, in one hour, the rectal instillation of ether and oil is begun. To carry this out one requires a rectal tube to which a glass funnel is attached by rubber tubing and a glass connection. The oil-ether mixture is a standard preparation[6] containing:

Quinine	gr. 20
Alcohol	m. 40
Ether	oz. 2½
Olive oil q.s. ad	oz. 4

This preparation is heated by placing it for a few minutes in a basin of warm water. The patient is put on her left side and the anal region is annointed with vaseline. An ounce of warm olive oil is poured into the funnel and allowed to enter the rectum slowly. When the funnel is nearly empty an additional ounce of olive oil is added in order to insure that all the mixture passes into the rectum. Pressure is then made over the rectum with a towel and the catheter is removed. Pressure is maintained for ten or fifteen minutes when as a rule all desire to expel the rectal contents will have disappeared. If the patient can be kept in a darkened quiet room the effect of this method is greatly enhanced. The patient should be constantly watched by an attendant. This method gives excellent results in many cases, but again is open to the criticism that severe restlessness and excitement appear in some patients. Little effect is seen in the newborn infant other than transient apnea.

3. *Barbiturates.* The most recent drugs used have belonged to the barbiturate group. Pernocton was one of the first of these. It is given intravenously in doses of 1 c.c. for each 12.5 kilos of body weight. Actually there appears to be a very large individual variation in the response to this drug as given intravenously and certain patients tolerate large doses before getting the desired effect. Two instances of fatal reactions following the use of this preparation have caused the abandonment of its use in New York City. Marked excitement and restlessness were commonly noted following its administration. Luminal and sodium amytal have also been used during labor. The most recent preparation that has been used extensively is sodium pentobarbital or nembutal. While this last drug has been used alone, it is most effective when used in combination with scopolamine. The optimum time of administration is about the same as noted in the other methods. Six grains of nembutal are given by mouth. Either immediately or one hour later, dependent on the intensity of the pains, scopolamine grain 1/150 is given by hypodermic. If an insufficient effect is obtained three grains of nembutal may be given two to three hours later, and a further dose at the same interval may be used in a prolonged labor. A rather rapid effect is attained, the patient sleeping

soundly and rousing only with pains. Again these patients may become excited and restless and require restraint. The best results from this method are obtained by careful individual attention to each patient and not by administering the drug on a time schedule. The effect on the baby is usually a transient apnea, although occasionally active resuscitation is required.

Nembutal and ether by rectum has also been used as well as nembutal by mouth and paraldehyde and oil by rectum. Since the author has had no experience in the use of these methods, no comment will be made. Avertin, evipal and spinal anesthetics have also been used, but since these are given late in the first stage of labor, they are really more concerned with second stage anesthesia and will not be discussed. One must conclude, however, serious defects are present in the three methods which have been outlined, and that the ideal method for controlling pain during the first stage of labor has not yet been discovered.

CONCLUSION

The duties of the physician during the first stage of normal labor are in the main that of a passive observer. Any active intervention must be carried out only after carefully weighing its effect on both mother and fetus. In addition the doctor must take due precautions to prevent the possibility of sepsis in the puerperium. He must carefully observe the condition of mother and fetus not only at the onset, but throughout the first stage, and be constantly on his guard against the occurrence of an abnormal labor. He must maintain the morale and nutrition of the patient. Pain must be relieved to the best of his ability, but not to the detriment of mother and child. Keeping these aims before him, in most cases the first stage of labor can be carried to a safe conclusion.

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TREATMENT OF THIRD STAGE OF LABOR

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I HAVE seen an attempt at manual removal of the placenta in which the physician's hand went through a rupture in the uterus and brought forth several coils of intestine avulsed from their mesenteric attachment. The placenta, of course, had previously escaped into the abdominal cavity through the same rupture.

I have seen inversion of the uterus which followed violent attempts to express the placenta by pressure on the fundus.

I have seen uteri quietly distend with enough blood to exsanguinate the patient and no one the wiser.

I have seen futile attempts to express an adherent placenta which produced tremendous abdominal bruising and disability.

I have seen immediate postpartum hemorrhage so profuse that death ensued in ten minutes, and others that were controlled and the patient saved only by a display of magnificient team work.

The third stage of labor which normally passes off so smoothly can suddenly or gradually require the utmost in obstetric experience, skill and technical resources to terminate it successfully and safely.

Nature handles this problem in two totally distinct and different acts; the first is separation of the placenta from the uterine placental site and the second is the extrusion of the separated placenta from the birth canal. Intelligent treatment of the third stage of labor is primarily dependent on the recognition of these steps.

Under modern conditions of delivery, the patient always recumbent, often under the influence of anesthetic, analgesic or amnesic drugs, the third stage terminates spontaneously in not more than 10 per cent to 15 per cent of all deliveries. In the remainder some form of aid is required. This interference to be helpful and not harmful must be based on a recognition of the two distinct acts mentioned.

Separation of the placenta occurs very rapidly after the birth of the child, usually in three to five minutes. Retraction of the uterus rapidly decreases the surface area of the corpus cavity. This normally involves the placental site which is near the fundus, the cotyledons are squeezed off of the network of maternal sinuses, the retroplacental blood gathers in the space between the two surfaces until finally the entire organ is loose and slides into the lower uterine segment. If the inferior margin of the placenta loosens first the retroplacental blood passes down the birth canal and out in a steady normal trickle. The placenta eventually follows, maternal surface first (Duncan). If the lower margin holds until the placenta slides down, the membranes invert above it and the retroplacental blood is held in this pouch of membrane until placenta and blood are extruded together. This placenta presents the fetal surface first (Schultz). These two types of delivery are determined in the lower uterine segment and not in the corpus uteri. Their clinical significance is merely an understanding of the steady trickle as something physiological while that placenta is separating.

SIGNS OF SEPARATION OF THE PLACENTA

1. Change in the shape and level of the fundus and corpus uteri. The broad thick corpus filled with placenta becomes more conical; hence the fundus level rises slightly reaching even a little above the umbilicus.

2. The depression above the symphysis fills out. The placenta has left the corpus cavity and lies in the lower uterine seg-

ment. Recognition of this sign requires an empty bladder and an abdomen not too fat.

3. Advancement of the cord. If a tape or instrument marker is placed on the cord flush with the vulva after taking out the slack in the cord and this is done *immediately* after delivery, the marker will advance 10 cm. to 15 cm. Obviously the placenta has moved the same distance from its placental site to its lodgement in the lower uterine segment and upper vagina.

4. Upward pressure on the corpus will drag the cord and marker into the vagina if separation has not occurred but will not do so if the placenta is out of the corpus cavity, i.e., is separated. This test is not desirable as it may contaminate the vagina.

In the further course of an unaided normal third stage of labor the woman becomes aware of painful contractions ten to fifteen minutes after delivery. She again bears down under this stimulus and the stony hard corpus uteri drives the separated placenta out of the birth canal. Unfortunately, as has been pointed out, this occurs in only a small percentage of deliveries.

DELIVERY OF THE PLACENTA

"Indirect expulsion" as described by the author affords the closest approximation to this spontaneous extrusion. It applies only to the *separated* placenta and requires an *alert cooperative* patient; it is then 90.0 per cent successful. The bladder should be empty. When the uterus is in stony hard contraction the recti muscles are grasped as in Figures 1 and 2 and the patient is told to bear down vigorously. This temporary reconstruction of the abdominal wall directs her voluntary effort against the corpus and the placenta is expelled.

Fig. 1. Indirect expulsion of the separated placenta. The abdominal recti are grasped at the outer margins in the upper abdomen when the uterus is in firm contraction. They are pulled together toward the midline and held while the patient makes a single vigorous bearing-down effort. (Curtis, A. H. Obstetrics and Gynecology, vol. 1. Phila., Saunders Co.)

Simple expression likewise applies only to the *separated* placenta. The conditions are identical with indirect expulsion but the physician, not the patient, supplies the expelling force by grasping the fundus uteri with one or both hands, (Fig. 3), and pushing downward, without squeezing. If this fails make sure that separation of the placenta was correctly diagnosed before trying again.

Normal spontaneous separation of the placenta is usual. Thereafter spontaneous extrusion, indirect expulsion or simple ex-

pression as outlined are the normal methods of delivery of the placenta.

The third stage of labor becomes abnormal if separation and advancement of the placenta does not occur. The placenta is usually adherent at the placental site. Occasionally it separates in part, uterine retraction and compression of the maternal sinuses fail to take place at the separated area and postpartum hemorrhage ensues. Sometimes the placenta is completely separated but its lower pole is incarcerated in the cervix and bleeding takes place into the corpus cavity with ballooning of the uterus followed by a sudden large gush of blood. Very infrequently (0.2 per cent) the attachment of the placenta is directly into the uterine musculature (placenta accreta). When this involves the whole placental site there is no bleeding.

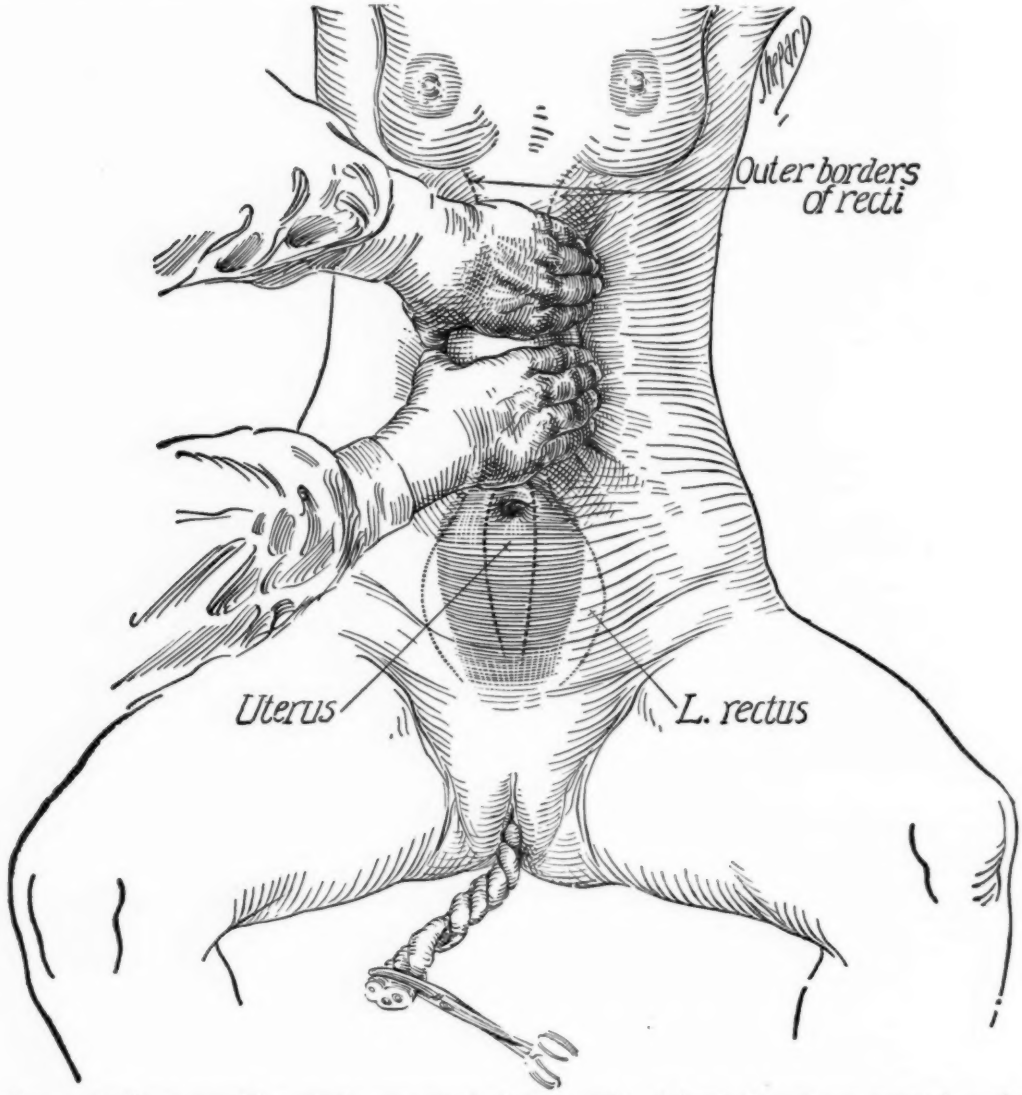

FIG. 2. Indirect expulsion of the separated placenta. The abdominal recti are grasped at the outer margins in the upper abdomen when the uterus is in firm contraction. They are pulled together toward the midline and held while the patient makes a single vigorous bearing-down effort. (Curtis, A. H. Obstetrics and Gynecology, vol. 1. Phila., Saunders Co.)

The Credé method of termination is indicated if the placenta is adherent or merely retained (Fig. 4). This procedure was devised to extrude the placenta from the corpus cavity but thirty minutes should elapse after delivery before this is tried.

The stony hard uterus is compressed to squeeze its contents out of the corpus cavity. If this is successful, the final delivery is accomplished by simple expression. If the Credé method fails it may be repeated every fifteen minutes, avoiding bruising of the uterus and abdominal wall. Gentle massage of the posterior surface of the uterus is justifiable to bring on the stony contraction necessary to carry out the technique.

Fig. 3. Simple expression of the separated placenta. The placenta lies in the lower uterine segment and upper vagina. The firmly contracted uterus, acting as a plunger, is pushed downward in the axis of the inlet without squeezing. (Curtis, A. H. Obstetrics and Gynecology, vol. 1. Phila., Saunders Co.)

Manual removal of the placenta is the last resort and least desirable method. The primary indication is postpartum hemorrhage. It must be remembered that postpartum hemorrhage may be concealed as well as external. The systemic evidences of such bleeding must be recognized before the blood loss is great.

Retention of the placenta without hemorrhage may occasionally be accompanied by symptoms of shock. This likewise

justifies manual removal. Finally, an arbitrary time limit of two hours of third stage

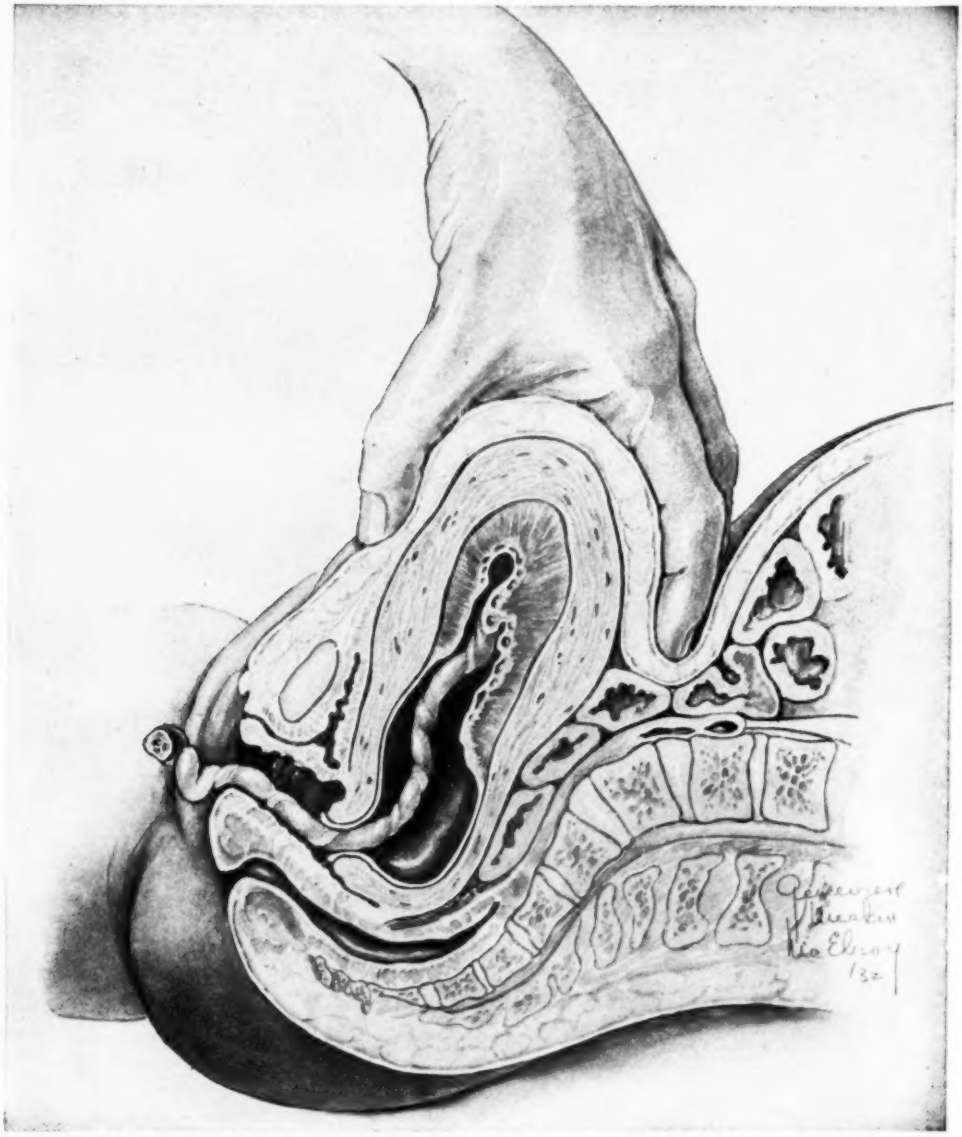

Fig. 4. Credé method. The placenta is not yet separated. The firmly contracted uterus is compressed, not pushed downward, in order to squeeze the retained placenta out of the corpus cavity. When this is accomplished the placenta is then delivered by a downward push as described for "simple expression." (Curtis, A. H. Obstetrics and Gynecology, vol. 1. Phila., Saunders Co.)

and failure of the Credé method is sufficient warrant for manual removal.

This procedure should be regarded as a major obstetrical operation. Fresh asepsis must be assured and anesthesia is required. The hand follows the cord to its point of insertion into the placenta while the fundus uteri is fixed abdominally by the other hand. The hand within the uterus is actually within the amniotic sac and not in the naked corpus cavity. Separation should begin at the most superior pole of placental attachment. The side of the hand is insinuated between placenta and uterus carrying the intact membranes ahead of it. As the placenta is loosened the hand is cupped above it and is withdrawn bringing the placenta out. Thus the hand has remained within the amniotic sac and the uterine cavity has not been soiled.

Failure to find a cleavage plane raises the suspicion of placenta accreta. If this low grade fever is not unusual under such circumstances.

Fig. 5. Inspection of the placenta. The placenta should be spread out on a flat surface, maternal side up. All blood clots must be gently wiped away. To expose the fetal surface the placenta should be lifted by the cord. This permits of careful and complete inspection of the placenta and membranes without the risk of producing artifacts or of overlooking any defects. (Curtis, A. H. Obstetrics and Gynecology, vol. 1. Phila., Saunders Co.)

is definitely diagnosed permission for a hysterectomy must be obtained.

Inspection of the placenta is an indispensable part of the treatment of the third stage. To avoid artifacts the placenta should be received in a towel, the membranes teased out gently and then the organ should be spread out on a flat platter (Fig. 5). Clots must be wiped off and the placenta should be handled by the cord rather than grasped directly and mutilated.

Diagnosis of missing placental tissue whether part of the main structure or an aberrant cotyledon (placenta succenturiata) requires manual search of the corpus cavity and removal of such placental tissue. Missing membranes may be ignored as they usually come away in the early puerperium. A foul odor and

Postpartum hemorrhage and birth injuries do not come within the scope of this article.

SUMMARY

The safe delivery of the placenta is more important to the maternal health than the safe delivery of the fetus. Recognition of separation of the placenta is an outstanding item in the conduct of the third stage of labor. Mechanism of placental separation and signs of separation are described. Spontaneous delivery of the placenta, "indirect expulsion," and simple expression are essentially physiological. Credé method and manual removal of the placenta represent pathology in the third stage of labor. The importance and technique of placental inspection are also given.

ANALGESIA AND ANESTHESIA IN OBSTETRICS

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IT is ninety years since Simpson's first use in obstetrics of inhalation of ether. He soon changed to chloroform for he had a progressive mind, always looking forward to change for the better. In 1870, his nephew, Alexander Simpson, reported analgesia in the first stage of labor, having stumbled upon it by chance. Having seen a woman with insufficient pains, he gave her some pills, presumed to be ergot. On returning to his home to await a call when her pains should become more active, he found that he had given her opium by error. When he retraced his steps to the patient's home, he found her sleeping; but soon she awoke, much refreshed; labor pains recurred with normal vigor with a satisfactory result. Thus was born analgesia and anesthesia in labor.

Everyone knows the hue and cry that developed from laity, clerics and physicians. History has repeated itself, for in 1936 at the Annual Meeting of the American Medical Association in discussion of three well developed papers on analgesia, the lay press printed some startling comments. One woman physician, who had borne three children, denied the right of women to have medicinal relief from the pains of childbirth. Eastern newspapers reported an eminent obstetrician as saying that he had seen hundreds of women die on delivery tables as the result of an analgesia he had introduced to America and he wished he could have undone it all! As if any obstetrician in the land has seen more than a few patients die on delivery tables from all causes put together! In the official report of his discussion, he referred to a death rate of 0.8 per cent in 490 hospitals, as bad as a hundred years ago, but how many of those deaths were due to scopolamine or any other analgesia he did not state.

While discussing the possible increase of operative interference, the world known obstetrician who has standardized and advocated prophylactic forceps had his picture on the cover of a news magazine with the caption that he "always lets the baby come." In the official report of his discussion, he made no mention of operative labors but said that "nobody uses that 'twilight sleep' now because, in the best of hands, it showed an irreducible mortality of 1 per cent." This is in spite of the fact that from one clinic, 3720 cases were reported with seminarcosis with an *uncorrected* fetal mortality of 2.6 per cent and 3446 cases without seminarcosis with a similar mortality of 4.1 per cent. He also stated that he felt "very decidedly that the magazines and the competitive practice of doctors have increased the fear of having a baby in the minds of the public."

Just as the laity has come to lose its fear of the pains of childbirth because it hears of analgesia, the lay press publishes poor conclusions from maternity mortality studies and erroneous statements attributed to the leaders.

While there occurred serious discussion and honest disagreement at Kansas City, how could the publicity department of the great American Medical Association allow such statements to be published in the Eastern newspapers?

Again I state that history keeps repeating itself. In discussing analgesia at the 1936 session, Baer of Chicago referred to the publicizing of "twilight sleep" by McClure's Magazine about twenty years ago; he should remember that in a few years the same magazine bitterly con-

demned it, claiming that many babies died of asphyxia and many mothers developed puerperal insanity.

To carry on from the pioneer work of the two Simpsons, progress was slow for sixty years. Opium or chloral during a long first stage and inhalation of chloroform or ether with pains, increasing to complete anesthesia for an operative delivery were all that was done, and that all too rarely.

Women after the Victorian era of resignation to the duties of childbearing began either to complain of their lot or to look for avoidance of childbearing by amateurish contraception. About thirty years ago, Kronig and Gauss began their use of morphine and scopolamine for the first stage of labor. This left the patient with enough amnesia so that they originated the phrase translated into English as "twilight sleep." It was observed at their clinic by numerous distinguished American physicians and was brought back for extensive employment in clinics here. Many wrote about it and many others practiced it who never reported the results. However, its later extensive condemnation, just or unjust, stimulated experimentation with other drugs and Gwathmey developed his technique of morphine and magnesium sulphate followed by ether, quinine and oil by rectum. It worked so well, particularly with multiparae, that it justly achieved much vogue. Women who had had a long tedious first labor with little or no relief medication went through the short multiparous labor under this regime with such good results that it was acclaimed as the *only* analgesia. A *lay* woman published a book which recognized *no* other method and heaped calumny upon the head of any physician who did not give it, willy nilly, to every woman in labor. It did not lend itself so well to long labors. It required nice technique to apply and there occurred some untoward complications due to carelessness in application.

More investigations were made in other fields. Spinal cord novocaine, paraldehyde, avertin, the barbiturates and similar hypnotics have all been used and in many instances with a large proportion of success as judged by the standard of the obstetrician. A vast amount of literature has been developed showing earnest and, as a rule, unprejudiced study. The indices of current literature in obstetrics will give as large a bibliography as on any subject in the specialty. To cover the literature would make this paper too voluminous but it is well to refer briefly to some results. The use of morphine and scopolamine has been discussed at intervals for many years and at the present time again occupies a position in the foreground. Almost all references referred to its danger to mother or babe. In 1923, in the Journal of the American Medical Association, Otto Schwarz of St. Louis reported two series each of 1000 cases of morphine and scopolamine analgesia. In the first, he found 80 per cent and in the second 88 per cent of satisfaction. Among all the 2000 labors there was no increase of fetal mortality or even of fetal asphyxia. This is particularly a combination for the first stage of labor, and its advocates admitted a larger use of forceps in the perineal stage; but perineal forceps is a practice becoming more and more common for other reasons in well organized clinics. The findings of Schwarz coincided with ours at the Brooklyn Hospital. When we did have mild degrees of asphyxia, we felt they might have been caused by the combination of these drugs. Our experience with morphine itself made us feel that bad effects upon the babes have been much overestimated.

Illustrative cases are frequent. A cardiac patient was so nearly decompensated that the baby was considered practically a by-product. She had a slow labor with an occiput posterior. During the twenty-four hours of her ordeal, she had 1 and $1\frac{9}{24}$ grains of morphine with some scopolamine, the last dose of the former having been $\frac{1}{3}$ grain given one-half hour before the child was delivered. There was deep ether anesthesia for a manual rotation and an extraction. The baby gave a lusty cry before the cord was tied and its hospital progress was uneventful. In November, 1936, another

cardiac had a labor which lasted for thirty hours after hospital admission. During it, she received a grain and a half of morphine. The last three doses of 1/8 grain each, were given during the last two hours preceding delivery; she had rectal instillations of ether and one hour inhalation of ether for a difficult delivery. Her baby breathed before completion of delivery, needing no resuscitation. A fortnight earlier, two multiparous patients had 1/6 grain of morphine and 1/200 grain of scopolamine and one received some ether and oil by rectum about one hour before delivery, yet neither baby showed any untoward effect.

Kugelmass of New York made extensive observations on the influence of morphine on the human and animal fetus and he feels convinced that the maximum effect on the fetus is during the period of three to six hours before delivery, disagreeing with the opinion of many observers. Shute and Davis of Chicago made both clinical and experimental studies on the effect of morphine and surveyed a large series of patients in labor and some babies experimented upon soon after birth, and felt that no baby was lost as a result of morphine narcosis. Going on to say, "it has been our experience that morphine is a safe drug to use in labor especially when adequate means of resuscitation are at hand. Many clinicians have relegated this drug to the background because of the possible development of the unpleasant complications of narcosis, only to make use of far more dangerous drugs of doubtful analgesic value."

From Schwarz' clinic in St. Louis in the November 21, 1936 issue of the Journal of the American Medical Association, has come an article by Krebs, Wulff and Wassermann who report on scopolamine-morphine seminarcosis in more recent years and come to the conclusion "that scopolamine-morphine seminarcosis is in no way increasing fetal mortality." This is after twenty years of use including several thousand cases. Our own feeling after many years use of morphine and scopolamine, first initiated at the Brooklyn Hospital by the late Dr. Ralph Pomeroy, is that we get a high degree of amnesia and analgesia; usually the second stage of labor, but rarely the first, is somewhat prolonged. There is poor cooperation in the second stage, resulting in an increase of perineal stage operations, and the babies at times are slightly sleepy. This in itself may be a blessing in disguise in that it prevents inhalation of foreign material from the lower birth canal.

In January, 1934, Irving and his associates at the Boston Lying-In Hospital reported eight series, each with a different type of analgesia. This was a particularly thorough study except that there were only 100 patients in each group.

His conclusions have influenced many obstetricians all over the country. They are that pentobarbital and scopolamine together make the most effective agent. "The sole objection is the high percentage of restlessness which we control by the supplementary instillation of rectal ether." He feels that opium derivatives should not be used in labor, "as they have a marked effect in delaying the initial respiration of the infant." Later he says, "it is likely that *all* hypnotic drugs or anesthetics given to the mother may delay somewhat the initial respirations of the infant. That this is not a valid objection to the use of such medication, however, is shown by the low stillbirth rate in the series and the fact that each stillbirth can be accounted for by other reasons than the effect of the drugs given to the mother." In effect, these two statements seem mildly contradictory.

Almost three years before Irving published his report, Boucek and Renton of the University of Pittsburgh did three series of experiments upon animals to determine the anesthetic dose of sodium amytal for a pregnant animal, the effect upon the fetus of that agent as an anesthetic for the mother, and also the effect upon the mother of injection of the fetus with sodium amytal. Their conclusions would certainly support Irving's contention that a drug in this group is safe for a fetus.

The most recent report on paraldehyde analgesia is from Moore and McCurdy

from Cleveland who used the drug alone or else with the addition of morphine, except in multiparae when sodium amytal was substituted for the latter. Their results are reported frankly, listing 76 per cent satisfactory and 4 per cent failures. Rosenfeld and Davidoff of Boston precede paraldehyde by 7.5 grains of nembutal. If this medication does not last sufficiently long smaller amounts of nembutal are used from time to time. Kane and Roth of Washington use paraldehyde first and, if sleep does not ensue in thirty minutes, ¼ grain of morphine is given. Colvin and Bartholomew of Atlanta begin medication when distress first occurs using sodium amytal and then, in slow labors, morphine and scopolamine in a magnesium sulphate solution after which paraldehyde is used. All users of paraldehyde instill it in the rectum in olive oil, except Kane and Roth who add benzoyl alcohol for its anesthetizing effect on the rectum and its relaxing effect on the cervix. All observers, including those who have used paraldehyde as a basal anesthetic, seem to feel that its toxicity is nil.

The use of avertin as a basal anesthetic in surgery instigated Cochrane of Brooklyn to use it as an analgesic during labor. In 150 cases he found no ill effects; he preceded the avertin with morphine and scopolamine until the cervix showed some effacement and one inch dilatation. Only 6 babies were somewhat sleepy; one premature, weighing five pounds, failed to breath but a few times. No hemorrhage or prolonged labor resulted from it. It is commonly used as a basal for cesarean section with excellent results. Within a year Gwathmey of New York and McCormick of Indianapolis have modified the former's technique of rectal analgesia, omitting magnesium sulphate and substituting nembutal by mouth; and to the ether and oil mixture adding 2 drams of paraldehyde. Their observation is that it is the safest of all satisfactory analgesias and can be used with patients with any type of complication such as cardiac disease, respiratory infections and toxemias. It is satisfactory as an analgesic in 85 per cent to 95 per cent of all cases.

Aside from the most common procedure of gas-oxygen during the second stage and at times, late in the first stage of labor, these methods seem the popular analgesias today.

With so many methods followed by numerous workers we are forced to remember Osler's philosophy that the more therapeutic procedures advocated for a disease, the less likely was any to be a specific.

Attempts to compare and to evaluate have been made several times, the most complete being "Current Technics for Obstetric Analgesia and Anesthesia" by Gould and Hirst* of Philadelphia. It was the result of a formal questionnaire answered by twenty-three different clinics. It is the best study of its kind that has come to our attention. Its value may be lessened somewhat because of its formality. With that in mind, I sent a questionnaire to fifteen colleagues whom I know intimately, asking as follows:

1. Did you ever know of any harm to mother or to baby from any form of analgesia?
2. Do you think one type of analgesia will fit all patients—primiparae and multiparae equally well?
3. In a woman who is getting into a prolonged labor—48 hours or more—what procedure would you follow for the relief of pain?
4. Can you say what analgesia is best for: (a) primiparae; (b) multiparae?
5. Do you feel that morphine has any bad effect on the baby?

This questionnaire, as expected, proved provocative, and as one recipient suspected, for he was "trusting that you will have a wide difference of opinion among the answers." The choice of the word "harm" in the first question may have been poor, but it was intended to mean damage. It is impossible to give a truly statistical answer to each of the questions; at best it will have to be a number of impressions, though some were monosyllabic, either "yes" or "no."

To Question 1: as to the babies, there were 5 "no" and 5 "yes"; others answered

*Am. Jour. Obst. and Gynec., 30: 257–263 (Aug.), 1935.

"respiratory centre depressed"; "yes, especially with morphine, or any if given within one to two hours before delivery"; "morphine too close to delivery will cause adverse effects"; "morphine and scopolamine necessitated artificial respiration for a long time in babies after easy labors"; one had "seen several morphinized babies that might have been revived under other analgesia than morphine."

As for the mothers, 9 reported no ill effects, and 6 said there were, one believing that a puerperal psychosis resulted for several months, but that was in a "very nervous patient"; another believed that deep inhalation narcosis of ether and more frequently chloroform would cause collapse and hemorrhage; and also harm to the kidneys and liver.

Aside from the statement that several had been impossible to revive after morphine, no one gave any proof that a baby was lost as a result of morphine poisoning. It is a known fact of consolation to obstetricians that many times babies are lost in the second stage of easy spontaneous labors; and that actuated DeLee to make forceps almost routine in the second stage of labor. Perhaps that was true of Potter and version. The woman who developed a psychosis probably had a low threshold of mental balance and the labor was enough to cause her trouble; this is, I believe, the accepted theory of psychiatrists. Would not an even heavier amount of analgesia been proper prophylaxis?

Galloway of Evanston reported that of 2200 labor cases, one only had died, and it occurred from hemorrhage sixteen hours after a cesarean section; and one woman became cyanotic after pentobarbital and scopolamine but improved with coramine and morphine. Of 1400 cases reviewed in relation to analgesia the maternal morbidity dropped from 5.6 per cent to 4.4 per cent and the fetal mortality from .87 per cent to .64 per cent, from previous reports in the same institution.

In answer to Question 2, 9 said "no" while 6 said "yes," one qualifying by using pentobarbital for all cases except a bad cardiac.

In the answers to Question 3, there was the greatest variation. The nearest approach to similarity were 3 who used morphine and barbiturates and later rectal ether and 2 of these added paraldehyde to the ether. Two agreed in that they individualized the care of such patients. One used morphine and scopolamine and repeated it, while another felt that morphine alone was the standby; the one who most nearly is the pioneer in pentobarbital used it followed by rectal ether and paraldehyde. Morphine and later nembutal was used by one; pentobarbital and scopolamine by 2; intermittent gas-oxygen by one; and another morphine, a bromide and chloral, and then rectal ether. One felt that a patient should not be allowed to go on in labor more than thirty hours but in long labors used nembutal and scopolamine, repeating the former as needed and using rectal ether in addition, if analgesia has not been sufficient. One of the strongest proponents of analgesia, I would like to quote:

> We do not have forty-eight hour labors so I do not know what to say. We have women who have spells of pains over a period of several days but they also have periods of rest and if they do not have such periods we give them enough pentobarbital to see that they do get rest. The main thing is not to shift from one drug to another and not to pile drug upon drug, in an attempt to give the patient relief. We think that after the patient has been given a reasonable amount of analgesic drugs and she is not benefited by them, all drugs should then and there be discontinued and the patient should be allowed to yell until the baby arrives!

Again in answer to Question 4, there were 5 who felt that they could not say which was the best analgesic for multiparae as distinct from primiparae; 10 felt that they did know; but of these, 6 gave pentobarbital and scopolamine to both; one gave nembutal and rectal ether and paraldehyde to both; one gave morphine, rectal ether and paraldehyde to both; 2 differentiated, one

giving morphine and scopolamine and rectal ether followed by gas-oxygen to primiparae, and to multiparae morphine and then gas-oxygen unless the labor was slow, when rectal ether was interposed; the other gave rectal ether and paraldehyde preceded by nembutal to primiparae but to multiparae morphine. In all these answers, there seemed a fairly general fear of morphine too near the time of delivery though this was not universal. No one reported a specific case of morphine death, to say nothing of postmortem proof of such.

With the multiplicity of opinions from literature and of personal communications as to whether or not any analgesia should be used and if so what, what conclusions may be drawn? Analgesia is humane, as much so as anesthesia; it is no more used as a method of competition among obstetricians than anesthesia in other types of surgery. It is a great help to finished obstetrics for, by controlling the morale of a patient, early radical meddlesome traumatizing interference, with its trail of morbidity and even mortality to mother and baby is obviated. This more than offsets the minor termination of labor in the perineal stage which may be needed by lack of voluntary efforts of sleepy patients. Many distinguished obstetricians at clinics noted for conservatism, point with pride to the excellent results of minor operative deliveries. DeLee of Chicago in contradition to the opinion given by one of the leading magazines, has repeatedly pointed out the hazard to mother and baby from a too long spontaneous passage of the head through the pelvic outlet. As a result he brought out his plea of "prophylactic forceps" with a wide lateral incision of the pelvic floor.

Proper analgesia and good obstetrics will, as the late Ralph Pomeroy said, "convert an unterrified and undamaged primipara into a competent multipara."

More women have gone to the psychopathic hospital who never had analgesia than those who have and I find no record of a psychiatrist today who will call analgesia the etiological factor in puerperal insanity.

To carry on the argument, we all have seen sleepy babies after easy spontaneous labors. While we may smell ether on the breath of a baby whose mother has been given it by rectum or by mouth, there has been no proof of a baby who has been narcotized to death from its mother's medication.

There is not yet the perfect analgesia. Many combinations are being used, sometimes of four to five drugs, the proponent calling it "synergism" and adverse critics "polypharmacy." It would seem to be fair to say that morphine best relieves pain; scopolamine produces amnesia even if not sleep; the barbiturates produce sleep as do paraldehyde and avertin; and ethylene, nitrous oxide, ether, and vinyl ether will produce partial or complete anesthesia. Ether and quinine and oil by rectum seem to hasten labor, when well started, both by the stimulating effect of quinine on the uterine musculature and the relaxing effect of ether on the cervix. Morphine is accused of depressing the baby's respiration, but to a fatal degree is as debatable as is the time of its use in relationship to birth. Scopolamine requires careful nursing with frequent review during labor as to dosage. It is no more likely to cause a puerperal psychosis than a single intoxication with alcohol. The barbiturates have been condemned for unsuspected susceptibility and for producing too great restlessness with its increased nursing burden, perhaps due to too great timidity in the size of the initial dosage. Paraldehyde is the safest hypnotic and will therefore have increasing vogue especially in combinations. Gas inhalation analgesia, starting on good dilatation of the cervix and sliding into anesthesia for delivery, seems as nearly perfect as possible in the rapid labors we expect of many multiparae, especially when it is preceded by a basal dose of morphine.

In long labors, morphine and scopolamine with an occasional repetition of the former, and regular, usually decreasing doses of the latter, will carry through many hours of a slowly progressing labor that is

found with a developing retraction ring, in a patient with little or no hind water and usually a posterior occiput position or an arrested breech. The barbiturates may have an equal effect with less frequent administration. If ever analgesia has been a life-saver of mother and baby it is in this type of labor. The primiparous mother has been spared the horrors of those hours of irritating if not agonizing pains and will cheerfully accept motherhood again. Moreover, this analgesia has saved many a woman from a cesarean section at an ill-timed period in her labor. Such a case requires meticulous attention with almost constant attendance, to prescribe proper dosage in addition to supportive treatment of the patient. Too frequently analgesia is discarded not because of its dangers but because of its exacting demands upon the obstetrician. Obviously, all analgesia, except a single administration of morphine, requires hospitalization. Minor operative interference, for the present, will remain frequent but major operative interference has been markedly decreased by analgesia and hospitalization.

CONCLUSIONS

Analgesia will continually improve, for it is here to stay. Intelligent women of character demand it; we must answer the demand not only in the name of humanity but in the interest of the race, for those are the women who should become multiparae and bring into the world a reasonable number of fine offspring to offset those of the lower stratum of intelligence and character.

America has been accused of a too high maternal mortality and morbidity, and ill-advised, ill-timed operative interference has contributed greatly to it but, if many of these women could have been properly hospitalized and properly medicated, major operative interference would have been vastly reduced with its trail of mutilated mothers and babies.

Anesthesia in obstetrics is a simpler, though not simple problem. The changed blood chemistry of a pregnant and parturient woman immediately separates obstetric anesthesia from surgical, especially if she has been receiving preliminary analgesia. The toxemias where the balance of blood chemistry has been lost make almost all observers agree that inhalation anesthetics, gas to the least degree, are strongly contraindicated. Spinal or local agents are life savers in these conditions, particularly the latter. In cesarean section, whether it be a classical or a low flap, local anesthesia is more and more the election.

Chloroform is little used today in this country, the old and dangerous tradition being exploded that it is more easily tolerated by a parturient than other women. However, Potter in his elective versions finds it indispensable for the extreme relaxation necessary for safe completion of the procedure. Relaxed as does become the uterus, he does not admit an undue incidence of postpartum hemorrhage.

In the presence of respiratory disturbance, local or spinal or rectal anesthesia is used with excellent effect and with no more danger than in surgery. In a bad grade cardiac patient, many internists advise open ether and oxygen, unless a local anesthetic will give assurance of success, and not add to the apprehension of the patient.

Whatever type of anesthetic has been elected, the administrator of it must become acquainted with the condition of the patient as to preliminary drugs, the duration and stage of labor, her previous fluid intake, and the possible amount of stomach contents, her state of fatigue, the condition of the respiratory and circulatory systems, and also the intended type of delivery.

The only conclusion is that anesthesia, like analgesia has a permanent place in obstetrics, as it has in surgery. However, it would seem that it must be given with even greater thought to the past and present condition of the patient, as well as her immediate and more distant futurities.

Let us look forward to analgesia and anesthesia becoming more perfect, safer, simpler and more frequently and more widely available.

RESUSCITATION OF THE NEWBORN*

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THE study of the development of a method in the prevention and treatment of disease will show that it evolves from an attempt to understand the normal conditions and the cause of abnormal alterations which surround and are produced by the pathological state of the organism. As newer scientific appreciation and knowledge develop and as experience over a long period of time is recorded, the method is discarded, changed, improved or substituted. The disease does not change even though there may be gradual transitions from one form to another. However, ideas related to the diseases do change and with that, naturally, the rationale of prevention and of treatment. Very seldom are there circumstances when one is unable to show how old the new is, and this may well apply to the methods that have been devised for the treatment of asphyxia neonatorum. Thus, it is not thought amiss to review briefly the historical development of procedures employed in the resuscitation of the newborn.

It was not until the middle of the eighteenth century that resuscitation of the newborn was considered with any real scientific approach. Perhaps one of the older methods, if not the oldest, which was employed before this time was insufflation. In connection with insufflation, it was soon learned that the air passages—the nostrils, mouth and pharynx—must be cleared of obstruction caused by the accumulation of inhaled foreign substances. One then, in the very early days, became aware of the most essential factor in effecting measures to resuscitate the newborn. Mauriceau in 1721 recommended holding the infant's mouth half open in order to cleanse it with a cloth pledget.

Among the first to practice insufflation with a cannula are Smellie and Monro Secundus. The former in 1768 used a silver cannula; Monro employed a cannula which he passed through the mouth down to the larynx preventing air from entering the stomach, an advance certainly in the art of resuscitation.

W. Cullen in 1766 advocated tracheotomy before insufflation, a procedure which was soon recognized to be much too radical.

Various methods of insufflation were being widely used until 1783 when Blumenbach, an opponent of the method, stated that it led to the death of many infants. He devised experiments on dogs to prove his contention. As a result Aitken, Hill and others recommended procedures by which pure atmospheric air could be lead into the air passages.

Hufeland in 1783 initiated for the first time the use of electricity in resuscitation of the newborn. He advised its application so that the heart and diaphragm might be stimulated to establish respiration. Among the many who have recommended electricity enthusiastically in some form or another as a measure of resuscitation since Hufeland may be mentioned Boër, Froriep, Herder, Ziemssen, Baer, Pernice, and only recently, Israel.

In 1785 Chaussier devised a "tube laryngien pour insouffler l'air dans les poumons." This tube was a curved silver cannula with a smooth, blunt, rounded end and two oval lateral openings a short distance from the end. When the wide usage

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of a catheter, tube or cannula in the numerous methods of resuscitation is considered, Chaussier's tube is a real advance, inasmuch as the delicate airways of an infant become less liable to trauma. The chief advocates of Chaussier's method and tube with their own personal modifications were Blundell, Depaul and Cazeaux.

The outstanding contribution of this earlier period was made by Paul Scheel in 1798. Scheel studied in Göttingen and Copenhagen, later becoming director of the Copenhagen Lying-In. He again placed, as many others had before him, the greatest amount of importance on clearing the air passages and was the first to recommend aspiration of amniotic fluid from the trachea. He stated that before anything else the mouth and pharynx of the newborn must be cleansed of mucus by means of a feather and the small finger. Then the head should be held downward so that the fluid substances in the pharynx might drain into the posterior nares. This should be followed by mouth-to-mouth insufflation with moderate compression towards the trachea and away from the esophagus in order to prevent the entrance of air into the stomach. If according to this procedure, the fluid did not flow out of the trachea, one should gently stroke the trachea again with the baby's head hanging downward and again air should be blown into the lungs by the mouth-to-mouth technique. Should one not accomplish one's purpose by carrying out these measures, then Scheel recommended clearing the trachea by passing a long flexible catheter into it and by means of a syringe attached to the other end, draw out the fluid by suction. After that, he continued, one can even make atmospheric air accessible to the lungs without having to take care of distending the intestinal canal through the esophagus. His procedure has been described in some detail purposely because, however crude and simple it was, there is much in the rationale that is fundamentally not unlike that which is practiced by the more commonly used and more refined methods of today. Scheel's work on the resuscitation of the newborn is impressive. He emphasized the importance of clearing the airways, used intratracheal intubation, and was the first to recommend intratracheal aspiration of amniotic fluid.

About 1801 Plenck placed much emphasis on the time at which the umbilical cord should be cut and tied. In asphyxia pallida, leaving the cord intact as long as the placenta is attached to the uterus, is advised; whereas, in asphyxia livida, the cord should be cut at once and a few ounces of blood allowed to escape before tying it. In the meantime, not less interesting and more important, are the various measures that he advocated for the stimulation of the infant, namely, wrapping the baby in cloths soaked in warm wine, giving spirits of hart's horn to smell and a small amount of salt by mouth, in addition to an enema of salt solution, blowing air in the mouth, stroking the soles of the feet with a brush, rubbing the limbs towards the heart with towels, and sometimes gently compressing the chest with the hands, omitting anything sudden or hasty.

In 1820 Stempelmann, influenced by the work of Blumenbach and Fleisch and Pittschoft, connected a double chambered bellows to a cannula instead of insufflating air. According to Arthur Keith, John Hunter used the bellows in 1776.

Blundell in 1824 recommended artificial respiration and the warm bath. He used a Chaussier tube for intratracheal intubation and gently pressed the thorax twenty-five to thirty times a minute to expel the air following each insufflation through the tube. He disapproved of the use of the bellows.

In 1828 Toogood advised mouth-to-mouth insufflation with a napkin between the infant's and operator's mouths and a hand on the chest to deflate the lungs. Dewees had employed the mouth-to-mouth technique with a cloth as recommended by Toogood for forty years.

Twenty years later, in 1844, Couper employed an interesting procedure in breech presentation, that is, inflation of the

lungs before the extraction of the head. Accordingly, he introduced the left hand in the vagina and inserted the forefinger in the baby's mouth, then using it as a guide, passed an elastic tube well into the infant's mouth. He blew two or three times through the other end of the tube in an attempt to establish respiration. The tube was not removed until delivery was accomplished. Baudelocque thought and made use of a similar procedure. In 1829 Dr. Jacob Bigelow presented in the American Journal of Medical Sciences an article "On the Means of Affording Respiration to Children in Reversed Presentation." In Pugh's Treatise of Midwifery (1754) he recommended such a method. Even though today the procedure is forgotten or verily unheard of in breech presentation, it does bear historical interest.

About the middle of the nineteenth century newer methods of resuscitation based upon posture and artificial respiration were introduced. The procedures outlined and proposed by Marshall Hall and Silvester gained much attention. About the same time Schultze's method became popular and shortly afterwards, his procedure was modified notably first by Byrd in 1874 and then by Dew in 1893. Howard in 1877 criticized the methods of Hall and Silvester because of the element of physical injury to the baby. Schultze's method was likewise one that exposed the infant to many hazards. These and allied procedures today are obsolete and because of the possible physical dangers to the newborn can be dismissed without any description.

Many recommended the use of the warm bath with Forest claiming to be the first to apply external heat and artificial respiration simultaneously. The so-called method of tubbing whereby the baby is placed in a bath of warm water then suddenly immersed in one of cold water is now held more injurious than helpful. It is obvious that the shock of the cold water cannot be of great benefit to an already feeble baby.

Laborde's technique of grasping the tongue and exercising rhythmic traction in order to establish respiration on the basis that the phrenic nerve is ultimately stimulated to cause contractions of the diaphragm and intercostal muscles is now held untenable as a satisfactory procedure.

Mention should be made of the use of drugs. In general the administration of the greater part of drugs has proved more injurious than beneficial. Lobeline, for example, unquestionably a respiratory stimulant, has been shown by many to be also a cardiac depressant. More recently and especially in Germany, good results have been claimed for coramine as a respiratory and cardiac stimulant. It is obvious that even if drugs may be administered with beneficial stimulating effect upon the cardiac or respiratory centers, or both, McGrath and Kuder have pointed out that "no drug therapy provides the fundamental clearance and patency of the air passages."

Many more and various methods have been devised in the past, all modifications of some one procedure or another that has already been described or mentioned.

At this point, the more current procedures will be considered. For the resuscitation of the newborn the fundamental requirement must be gentleness and as Plenck once said, anything sudden or hasty must be omitted. The principal objective is to get the air passages from the lips to the lungs clear. The greatest caution should be exercised to avoid any posture or procedure that will add insult to a suspected intracranial injury. As long as the heart beat is strong and the rate regular, and as long as the pharyngeal and laryngeal reflexes are not feeble, the usual milder measures will suffice to resuscitate the newborn should it not cry shortly after delivery. Suspending the newborn infant by its feet with the head hanging downward and gently stroking the trachea towards the head, cleansing the mouth and pharynx with the little finger covered by a soft piece of gauze, preventing undue exposure by wrapping the infant in warm blankets and placing it in a warm basinette

are all generally well accepted measures. Should one suspect the incomplete removal or drainage of mucus and fluid from the air passages, the careful introduction of a soft rubber catheter into the posterior pharyngeal spaces or into the trachea, with suction applied, will suffice to accomplish the purpose. Babies with partial asphyxia, that is, babies with a good fetal heart and cyanosis, with attempts to breathe, are made to inhale a mixture of 5 to 10 per cent carbon dioxide and 90 to 95 per cent oxygen (Fig. 1). After the air passages have been cleared as described, such a measure has been found very effective in stimulating respiration.

Fig. 1. Inhalation of CO_2 and O_2 with artificial respiration in partial asphyxia (good fetal heart, cyanosis with attempts to breathe). (Stander, H. J. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century, 1936.)

In the presence of a poor response or no response, that is, change in the infant's complexion for the worse, a feeble and irregular heart beat, failure to show any sign of a respiratory movement, more urgent measures are indicated. Today the better devised procedures aim to supply the infant with artificial respiration and oxygen or a mixture of oxygen and carbon dioxide. The desirability to obtain an adequate rhythm to establish respiration and to follow it after it has been established, in addition to preventing injury to the tissues of the pulmonary unit by administering gases under undue pressure, are obvious factors to be considered. Apparatus have been devised in which the rate of inflating the lungs can be regulated and the mixture as well as the administration of gases realized under controlled pressure. The apparatus of Drinker and McKhann, of Kreiselman, Kane and Swope, and that of Flagg deserve special mention.

In this clinic the method of direct exposure intubation with a small size laryngoscope and controlled intratracheal insufflation of 10 per cent carbon dioxide and 90 per cent oxygen under measured pressure as devised by Flagg has proved very satisfactory. The resuscitation outfit and the technique as employed in our clinic and as described in the 1936 edition of Williams' Obstetrics are as follows: The outfit consists of a small size laryngoscope, a straight as well as a curved metal suction tube, connecting with an electric suction apparatus, and a Flagg resuscitation machine carrying two containers of 10 per

cent carbon dioxide and 90 per cent oxygen, to which may be fitted either an infant insufflation tube or a baby pharyngeal airway. In addition there is available an infant size resuscitation inhaler for use when intubation does not seem indicated; this can also be fitted to the Flagg apparatus (Fig. 1).

Fig. 2. Suction applied directly into trachea which has been exposed by means of the Flagg laryngoscope. Used in cases with slowing of the heart rate, cyanosis and obstruction with large amounts of mucus. (Stander, H. J. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

When the more serious forms of asphyxia prompt it, the baby is placed flat on its back with the shoulders slightly elevated and the head in somewhat hyperextension. Then we resort to the use of the infant laryngoscope, exposing the trachea and, under direct vision, the straight suction tube is inserted into the trachea and all the mucus removed under controlled electric suction. With the laryngoscope still in place, the infant insufflation tube now replaces the suction tube and by connecting this with the Flagg apparatus, carbon dioxide and oxygen in the mentioned concentration under a pressure of twelve inches of water (25 mm. Hg) is forced into the trachea by obdurating the respiratory part of the insufflation tube with the thumb and deflating it by removing the thumb, at first simulating as nearly as possible normal respiratory rhythm. In this manner the obstetrician is given complete control over the respirations he is attempting to induce. However, since the carbon dioxide content of the blood effects respiration and this in turn is dependent upon proper oxygenation once respiration is established, the rate and rhythm of the newly established respiration should be followed by the operator, as any attempt to set an artificial rate and rhythm will serve to inhibit the newly established respiratory effort. Once this procedure is begun, the laryngoscope is removed while the insufflation tube remains in situ and the procedure continued until respirations are spontaneous and regular and the color of the infant is normal. It is sometimes necessary to continue this for an hour or longer in order to bring about normal respirations (Figs. 2 and 3).

There is a great need for a standardized and well organized method of resuscitation of the newborn in every hospital or institution where obstetrics is practiced. In gen-

eral, the subject of resuscitation of the newborn has not been treated seriously enough. A study of the statistics in the Birth Registration area of the United States shows that within the first twenty-four hours after birth about 110,000 newborn babies are lost annually. If this figure is correlated with the number of live births, it will show that about one baby out of every 20 dies from some obstetrical cause. Cruickshank, carefully studying the autopsy findings of 800 neonatal deaths (excluding stillbirths) which occurred in the first four weeks after birth, showed that 67.5 per cent resulted from causes associated with childbirth, that is, asphyxia neonatorum, prematurity, congenital atelectasis, or birth injury. The interrelation among these four causes of neonatal death is so close that any attempt

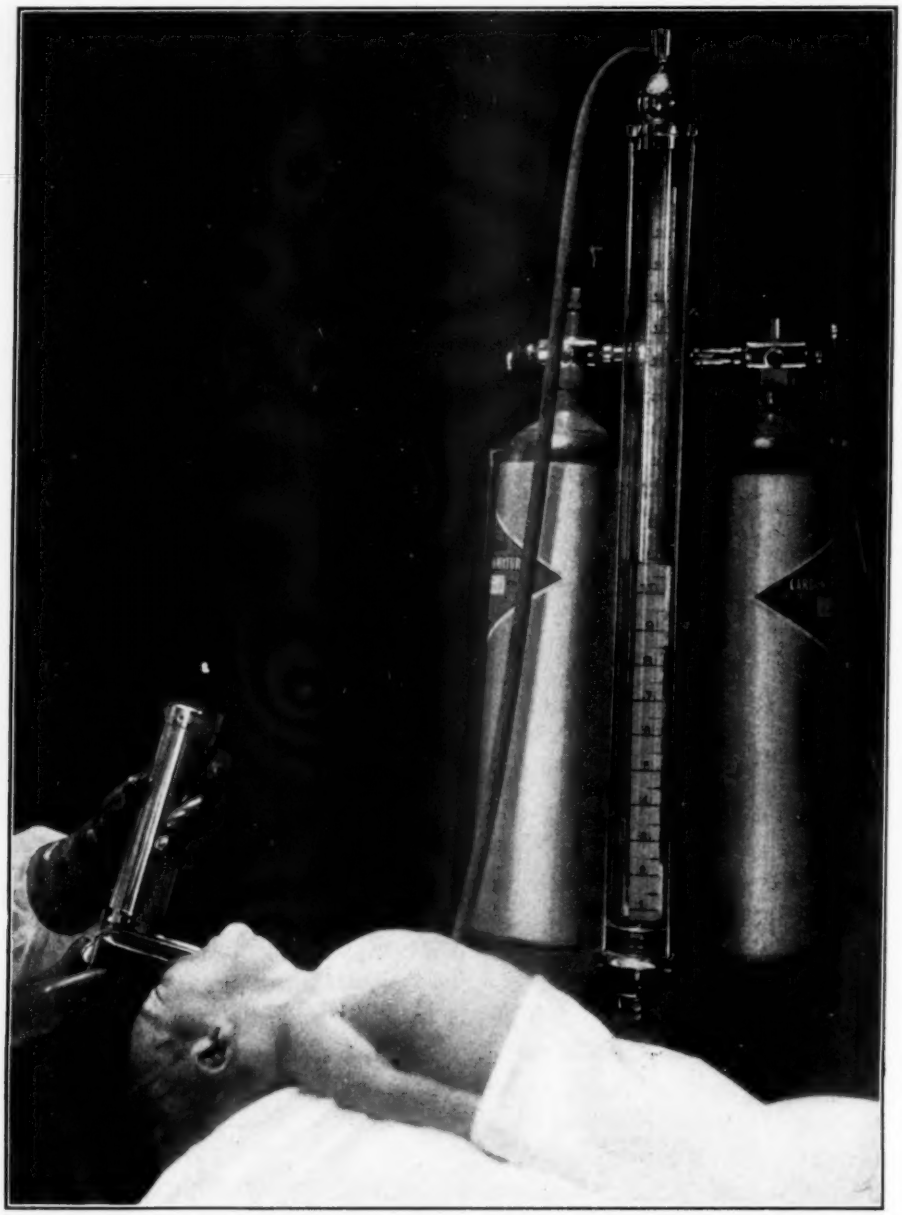

Fig. 3. Insufflation tube replacing suction and connected with CO_2 and O_2 under controlled pressure with thumb obdurating the respiratory port. This step follows the one illustrated in Figure 2. (Stander, H. J. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

to draw a line of demarcation in order to discuss them singly is well nigh futile.

Asphyxia neonatorum may be of intrauterine or extrauterine origin. The intrauterine origin may be maternal or fetal. Under the maternal factors that may cause asphyxia of intrauterine origin are enumerated disturbances of the placental circulation of any form during labor, protracted labor, prolonged second stage, administration of drugs during labor, hemorrhage, convulsions, and death of the mother. Under the fetal factors are considered pressure on the cord, winding of the cord about the baby's neck and pressure upon the head. Extrauterine asphyxia may be primary to disease or malformation of the vital organs, or secondary to injury to the brain or any other vital organ. Premature infants because of imperfect development should also be considered under this heading. The best way to treat asphyxia is to make every possible effort to prevent it. It is especially under the heading of its intrauterine origin that the best efforts of good obstetrics can be directed. In connection with the use of drugs, analgesics and anesthetics during labor, Irving presented the following figures: Of the patients who received no analgesia, 98.1 per cent of their babies breathed at once as soon as delivered; of those who received nitrous oxide, oxygen and ether, 80 per cent breathed at once; and of those who received drugs (barbiturates, rectal ether, paraldehyde, scopolamine), 50 to 65 per cent of their babies breathed immediately. These figures should make one guard against the indiscriminate use of such necessary agents during labor.

Jörg in 1832 was the first to describe and differentiate atelectasis from pneumonia in the newborn. Lord states that weakness or underdevelopment of the respiratory muscles such as in premature or weakly infants, or diminished irritability of the respiratory center from intracranial hemorrhage, compression of the skull, or injury of the spinal cord during birth, may be the cause of congenital atelectasis in the newborn. Prolonged or difficult labor favors its occurrence. However, the most important and most frequent cause is mechanical obstruction by inhaled amniotic fluid, meconium, or mucus before, during or immediately after birth. Lord further states that after the baby is born alive, cries and lives several hours, acquired atelectasis may be caused by obstruction of the air passages or retraction or compression of the lungs.

SUMMARY

The writer wishes briefly to summarize the theories advanced for the cause of the onset of respiration before concluding. There are three hypothetical factors that may initiate the expansion of the lungs and thereby establish respiration in the newborn: the physical, chemical and biological. Under the first, Preyer's theory is that the infant begins to breathe at birth as a consequence of reflex stimulation set up by the trauma resulting from labor. When one considers how adverse and difficult labor may be and the injury that the newborn may sustain as a result, such a theory is obviously untenable.

Others propose that inasmuch as carbon dioxide stimulates the respiratory center, it is the increase in carbon dioxide tension in the blood of the newborn at the time of birth that initiates respiration. Eastman has shown from his studies on the fetal blood that the baby will begin to breathe whether the carbon dioxide tension is either high or low. This leads one to question definitely this hypothesis. Barcroft, from his recent studies on the goat, proposes that the initiating factor is a lack of oxygen, a minor degree of anoxemia. This again has been shown by Rosenfeld and Snyder not to be the case. From the evidence that is available, it appears that chemical factors do not entirely satisfactorily explain the onset of respiration.

Rosenfeld and Snyder, by ingeniously planned experiments, have demonstrated in rabbits the existence of rhythmic respiratory movements that simulate those of extrauterine life. This phenomenon may

be considered the biological factor and as Eastman points out, the work of these investigators has far reaching implications. It is difficult to understand how such a vital function as respiration should suddenly become initiated as soon as extrauterine life begins. Cardiac, hepatic and renal mechanisms begin in intrauterine life. Respiration as a function is vital; as a process it is mechanical. This reviewer is led to believe from all the evidence at hand that the mechanism of respiration biologically is established in intrauterine life and assumes its vital function at birth. This function may well be awakened by a combination of the chemical factors considered in the foregoing. It appears pertinent to close this paragraph by quoting Eastman: "Instead of being an attempt to start something new, the treatment of apnea at birth now becomes an effort to preserve and safeguard a sensitive mechanism already in active existence."

In relation to the brief historical survey that has been presented of the methods used in the resuscitation of the newborn, a comment made by Thomas Denman in an early American edition of his Introduction to the Practice of Midwifery (1807) is worthy of repetition:

> In all these different methods, and many others founded on caprice, or on directly contrary principles, children have been treated in different times and countries, and yet they have generally done well; the operations of Nature being very stubborn, and happily admitting of considerable deviation and interruption, without the prevention of her ends.
>
> There is yet in all things a perfectly right as well as a wrong method; and, though the advantage or disadvantage of either may be overlooked, the propriety and advantage of the right method must be evidently proved by individual cases, and of course by the general result of practice. In this, as well as in many other points, we have been too fond of interfering with art, and have consigned too little to nature, as if the human race had been destined to wretchedness and disaster from the moment of birth, beyond the allotment of other creatures.

CONCLUSION

1. A brief historical survey of the methods that have been used for the resuscitation of the newborn is presented.

2. Gentleness is the fundamental requirement, and getting the air passages from the lips to the lungs clear, the principal objective for the resuscitation of the newborn.

3. Generally well accepted measures are enumerated for the stimulation of respiration in babies who do not breathe spontaneously shortly after birth as a result of a milder form of apnea or partial asphyxia.

4. In the more serious forms of asphyxia neonatorum, the better devised procedures aim to supply the infant with artificial respiration and oxygen or a mixture of oxygen and carbon dioxide.

5. The method of direct exposure intubation with a small size laryngoscope and controlled intratracheal insufflation of 10 per cent carbon dioxide and 90 per cent oxygen under measured pressure as devised by Flagg is used in this clinic with very satisfactory results. The method is described in detail.

6. A brief summary of the theories advanced for the cause of the onset of respiration is given.

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POSTPARTUM CARE*

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"POSTPARTUM care" and "postnatal care" are terms which are sometimes used as synonyms, but their real significance is somewhat different. The former applies more specifically to the mother, and the latter more definitely to the infant. The difference in their significance and application is more marked than that between the terms "antepartum" and "antenatal" because the relationship between the mother and the infant is less close than that between the mother and the fetus.

The postpartum care is both immediate and remote. It begins with the completion of labor and extends through the puerperium and until such time as the mother is restored to at least relative normality. This does not mean that certain fundamental changes have not occurred which are inherent in the process of childbearing. These are anatomic, physiologic and psychologic. The mother is subsequently not quite the same individual, which does not mean that she is not normal but does imply that the standard of normality has been changed. It is readily understood that very marked changes have taken place in the maternal organism during pregnancy and labor. Tremendous adjustments have to be made and the major purpose of postpartum care is to assist natural processes and facilitate the structural and functional restoration.

Postnatal care is so intimately connected with postpartum care that we shall consider it briefly here. Postnatal care is directed toward the infant and begins immediately with the birth of the fetus and continues during the newborn or neonatal period of its life, about four weeks.

The cutting-off of the placental circulation is counterbalanced by the establishment of the pulmonary circulation. The ingestion of fluid and food substitutes alimentary assimilation for uteroplacental metabolism. The digestion of food in the stomach and bowels initiates the function of the gastrointestinal tract. The transition from the regulated intrauterine temperature and pressure to the external thermic and atmospheric conditions requires the adjustment of the thermoregulatory mechanism of the fetus and the proper functioning of the cutaneous, the peripheral vascular, and the nervous systems. These and other rather delicate mechanisms begin and ultimately complete the transition of the fetus to the infant through the neonatal period. The care administered to the newborn infant from the moment of birth should be such as to facilitate the transition and to avoid the introduction of any detrimental factors.

The obstetrician who is responsible for the welfare of the fetus during pregnancy and labor cannot escape administering care to the newborn infant immediately subsequent to its birth. The necessity of avoiding the possibility of either refrigeration or heat stroke by maintaining proper temperature for the baby from the moment of birth, is obvious. This is particularly important for immature and premature infants. There are various methods of applying heat but one of the best is by means of a properly adjusted heat lamp which may reflect heat upon the infant from the time it is

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born until it is ready to be placed in the warming crib or in the incubator.

The establishment of respiration is most important and the nasopharynx should be cleared promptly of secretions to prevent aspiration to a lower level. This should be accomplished by suction without traumatizing the mucous membranes. Inversion of the infant is helpful in preventing aspiration, and the tracheal catheter is invaluable when tracheal aspiration occurs. After the prompt freeing of the upper respiratory passages is accomplished, the immediate establishment of respiration is essential. The administration of oxygen is of the greatest importance in many cases, and it should be employed early before tissue changes can take place as the result of long continued cyanosis. Only gentle methods should be used in attempts at resuscitation. Often the upper respiratory passages should be cleared before the cord is ligated, although the separation from the placenta facilitates handling the baby. Numerous methods of treating the cord have been advised and devised, but any procedure which avoids infection and prevents bleeding is satisfactory. Ligation is good and many types of clamps more or less satisfactory, have their advocates.

The eyes should be cleansed and several drops of a fresh 1 per cent solution of silver nitrate instilled into the conjunctival sac. The skin should be carefully oiled and cleansed, avoiding trauma, and anointed with half strength ammoniated mercury ointment to prevent infection. The subsequent care of the infant, while vitally important, need not fall to the lot of the obstetrician as the pediatrician is usually available at the door of the nursery.

The major purpose of this contribution is to give some of the essentials of adequate postpartum care. The mother has been delivered of the baby and the placental stage is completed to inaugurate the postpartum period or the puerperium. One specter which always stares the obstetrician in the face is the danger of a postpartum hemorrhage. The amount of blood loss is by no means constant. It may be minimized largely by the proper method of conducting the third stage of labor and the immediate postpartum period. It should be kept in mind that patients who are anemic and those who have lost blood prior to or during labor are less able to withstand postpartum blood loss than those who are not thus weakened. It should also be remembered that certain conditions favor postpartum hemorrhage. Placenta previa and premature placental detachment are among these. Prolonged anesthesia, long labors, operative deliveries, complicated third stage, large babies and their large accompanying placentas, and overdistended uteri are all factors which predispose to postpartum hemorrhage.

The average blood loss should not exceed 300 c.c. Therefore, one may assume that a loss of between 300 and 500 c.c. is excessive but we are inclined not to consider it a postpartum hemorrhage unless the blood loss is more than 500 c.c. The total blood loss should be considered and not solely the quantity lost after the delivery of the placenta. The greater the loss prior to the ending of the third stage, the less the quantity which can later be spared.

In all cases good postpartum care will seek to minimize the amount of blood loss. The methods of accomplishing this major objective may be enumerated as follows: Concomitantly with the delivery of the placenta the behavior of the uterus should be observed and controlled. The activity of the uterus at this time is modified by previous events and especially by the anesthesia. It is unwise as a rule to continue anesthesia during the third stage of labor because of the tendency to interfere with normal uterine contractions. The prevention of postpartum hemorrhages is not always possible, but deaths from this cause can usually be avoided. The uterus should contract well and not rise above the umbilical level during the postpartum period. Contractions may be stimulated or maintained by manual methods which should never be rough. The routine hypodermic

administration of ergonovine or pituitary extract is valuable in avoiding uterine relaxation.

If bleeding occurs in spite of these prophylactic measures, one should immediately think of three possible causes of the hemorrhage: (1) atony of the uterus with bleeding from the placental site; (2) trauma with involvement of important veins or arteries; and (3) retained placental fragments.

The treatment consists of the control of the bleeding from the uterine vascular sinuses by excitation of uterine contractions or by traction or marked anteflexion of the uterus, by compression of the sinuses by a uterine pack, and the diminution of the uterine blood supply by aortic compression or by checking the uterine circulation by means of clamps. When bleeding comes from injured vessels, compression, suture or removal of the uterus may be necessary.

If the placenta and membranes are incomplete and bleeding occurs, the fragments should be promptly removed manually without added trauma to the genitalia. Following such removal other measures may be necessary to prevent further blood loss or to control actual bleeding. All cases of hemorrhage require rest and fluids to replace the loss of tissue fluids.

The mechanism of death from hemorrhage explains the rationale of treatment. Hemorrhage first leads to a loss of intravascular fluids which causes a reduction in volume with a fall in blood pressure. This may be compensated in part by vasoconstriction. The heart works upon a certain fluid volume against resistance which, when diminished below a certain level, leads to an incapacity to perform its work properly. When blood vascular fluids are depleted, the fluids from the lymphatics and tissue spaces are withdrawn to replace the loss. If this demand is sufficiently insistent and prolonged, the cellular metabolism is harmed by a disturbance of the water and mineral metabolism. This may result in cellular damage of a degree sufficient to prevent subsequent recuperation of the cells; in other words, the cells become moribund or die. If this occurs, no treatment will save the patient's life.

It is important, therefore, to initiate proper treatment promptly so that serious abstraction of tissue fluids does not occur. Since hemorrhage is usually unexpected and constitutes an emergency, one should be prepared in advance to meet it. The principles of treating all hemorrhages are pretty much the same. They are, first, the prevention, second, the control, and third, the replacement of the fluid volume, the viscosity of intravascular fluids, and the lost constituents in so far as possible. Methods for the prevention and control of postpartum hemorrhage have already been mentioned. The replacement may be accomplished by several routes, by mouth, per rectum, subcutaneously and intravenously. It should be mentioned that the intravenous injection of any fluid, with the possible exception of blood, until the bleeding is under control or has been stopped, may prove dangerous as the artificially diluted blood may be washed from the vessels. The fluids used should be isotonic and should replace both fluids and minerals. Sugar solutions are also of value. Ringer's solution with or without glucose is one of the most valuable. The use of any hypertonic solution intravenously is contraindicated as it may increase the abstraction of tissue fluids and promote elimination, both of which are undesirable in bleeding cases. When it is necessary to increase the fluid volume and blood for transfusion is not available, a 6 per cent solution of gum acacia may be used to advantage. There is no real substitute for transfusion of whole blood which has been properly grouped, matched and Wassermann-tested. All hospitals caring for maternity cases should have universal donors and those who have been properly tested available to meet emergencies. It apparently makes little difference whether direct or indirect methods are used or whether the blood is citrated

or not. The operator should know the technique used.

In the treatment of hemorrhage, especially when genital manipulations are required, it is important to maintain aseptic technique as there is little gained in saving a patient from death by hemorrhage to have her die later from infection. Rigorous technique is of added importance because these women who suffer from acute anemia may acquire an infection more readily, to which they have a lowered immunity.

As a rule, the danger of postpartum hemorrhage diminishes rapidly with the lapse of time following delivery. The patient should be closely observed for at least one hour following delivery. Delayed and late postpartum hemorrhages may occur and are usually due to secondary hemorrhage from wounds, from retained placental tissue or from neoplasms. The treatment is essentially the same as that already outlined except for those patients having tumors, in which event the management becomes essentially that of the tumor itself.

The subsequent treatment of anemic patients depends partly upon the degree of anemia. This may be low enough to require subsequent transfusions plus special therapy and dietary management. It would seem almost axiomatic that aseptic technique should be continued throughout the postpartum period. It should not be necessary to describe the essentials of asepsis as they are basic for any type of surgical and even of medical practice. The continuation and carrying out of this technique become of added importance where any trauma has occurred which required surgical treatment.

One important step in the immediate postpartum care is the diagnosis of the existence of any traumatic lesions, especially of those which may require reparative procedures. In certain cases complete or incomplete rupture of the uterus may be suspected. Ordinarily a properly indicated and performed forceps operation does not expose the patient to the danger of uterine rupture. Mutilating operations, such as craniotomy and embryotomy, which are commonly associated with fetal malpositions and a dead fetus, do expose the woman to such a hazard. The correction of fetal malpositions and versions and extractions are always attended by such a risk. Placenta previa predisposes the cervix and lower uterine segment to lacerations which may occur as the result of the varied manipulations employed in the treatment of this condition.

The method of diagnosing uterine rupture is manual exploration of the uterine cavity. This is accomplished by inserting the hand into the uterus and passing it first in one direction and then in the opposite in order to palpate any defect in the uterine wall. One should not employ this diagnostic procedure except in indicated cases and then only with careful technique. When such a condition is found, treatment by packing, suture, or hysterectomy has to be instituted.

The question of routine inspection of the cervix has been discussed for many years but it would seem to be justified only in cases of mechanical induction of labor, artificial conduct or termination of labor, and in patients who have postpartum bleeding. When injury of the cervix is suspected it should be carefully exposed with a speculum or vaginal retractors and the margins carefully followed around the complete circumference by picking up the edges with ring or with tissue forceps. If lacerations are discovered they should be sutured. One should make certain that the upper angle is reached, that the sutures are so placed as to secure proper apposition and are not tied too tightly.

One should always determine whether or not there are vaginal, perineal or vulval tears. They should always be repaired. In suturing vaginal tears one should always expose the upper angle, secure proper apposition, and avoid inversion of the torn edges and the passing of sutures into the rectal wall. Interrupted or continuous sutures may be used.

Various methods for repair of lacerations and episiotomy wounds have been advised with the use of absorbable and non-absorbable, superficial and deep, continuous and interrupted sutures. The result is probably dependent more upon the asepsis and the technique than upon variations of appropriate suture material so long as the suture is one which will maintain apposition of tissues for a week.

The principles of anatomic restoration are simple and will result in the approximation of the severed structures. These simple principles are the reformation of the triangular form of the perineal body, the reestablishment of the backward inclination of the vagina, and, lastly the restoration of the introital ring. Vulval injuries are easily repaired and, as a rule, are located anteriorly in the labia minora and in the region of the clitoris. These repairs may be made under local anesthesia, or inhalation anesthesia may be used after the likelihood of hemorrhage has passed.

The immediate care of the mother is completed with the cleansing of the genitalia, the breasts and the nipples and the patient's recovery from the anesthetic. Watchful expectancy should be maintained with continued asepsis, particularly of the genitalia and breasts.

The woman usually requires rest which should, if necessary, be secured by the use of hypnotics and analgesics. The nursing mother should receive plenty of readily digestable low residue food, at least while she is confined to bed. The diet should contain adequate fluids, abundant proteins, vitamins and minerals.

Enemas and laxatives should be avoided in so far as possible. If necessary, small enemata may be used during the puerperium.

The urinary tract should be protected from infection and by careful periodic catheterization the bladder kept free from trauma due to distention.

The breasts and nipples must also be carefully guarded from infection and from trauma caused by prolonged nursing or other mechanical injury.

Genital hygiene is imperative and attendants should avoid the conveyance of infection by spray or droplet.

The general condition of the patient must be maintained at a proper level or be improved. Anemia should be combated, and rest with subsequent appropriate exercises and postures be employed. The muscles of the extremities and abdominal wall are the ones which require some motion and use by either passive or active methods. The patient should change her position in bed frequently, be allowed to sit up in bed within a few days and out in a chair in nine or ten days.

After three weeks the usual activities may be resumed gradually but loss of sleep and physical and psychic fatigue must be avoided.

The complications which may arise are numerous, but major ones are not common. The follow-up of the mother as well as of the baby is important. The mother should be reexamined in about six weeks, and the care should be continued for months in the usual case. In other instances more frequent and long continued visits and special treatment may be required until she has returned to normality. Future pregnancies should be discussed and necessary information given to avoid a subsequent pregnancy until the patient is in condition to pass through another pregnancy and labor without detriment.

No definite time limit can be set for this as it will vary greatly in different individuals. Some women can tolerate a number of pregnancies better than another can go through a single gestation. As a rule a minimum of eighteen months should elapse between pregnancies. The relations of child to child in the family should be considered as well as those of mother to child. It is important that the childbearing woman be kept under medical care by periodic, though not necessarily frequent, examinations except during pregnancy or

while afflicted with some disorder which may require more frequent observation and treatment.

SUMMARY

The postpartum care of the mother and the postnatal care of the infant are both immediate and remote. No attempt has been made to discuss the details of remote postpartum and prenatal care. The immediate postnatal care is important from the standpoint of securing the proper adjustment of both premature and mature infants up to an extrauterine environment. One of the most important of these adjustments is the proper establishment of respiration. The prevention of hemorrhage and the avoidance of infection are of extreme importance. The immediate postpartum care of the mother has three aspects of major importance; the conservation of blood loss, the prevention of infection, and the repair of injuries. The subsequent care of both mother and infant should attempt to secure and maintain normal health.

PYELITIS COMPLICATING PREGNANCY*

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PYELITIS is one of the commonest complications of pregnancy and the puerperium. Its occurrence at the New York Lying-In Hospital is observed twice in each 100 pregnant women. The relative incidence as compared to other common complications of pregnancy is shown by the following table:

	Per Cent
Pyelitis	2.02
Chronic nephritis	2.29
Cardiac disease	3.66

Such frequency of occurrence as well as the damage to the urinary tract that may result demand the earnest attention and the most careful treatment of the disease of which the profession is capable.

The disease may appear at any time during pregnancy, or soon after delivery. It is seen almost as frequently in primiparae as in multiparae. The right ureter and kidney pelvis are involved much more commonly than those of the left side, although leftsided and bilateral disease are seen, the latter carrying with it a more sinister prognosis.

In our experience it is rarely possible to demonstrate either from the history of the patient or by bacterial culture methods that there has been a preexisting chronic pyeloureteritis. A small group of patients give a history of having had this complication in a previous pregnancy, and more infrequently, the story of undoubted pyelitis before becoming pregnant for the first time. In all probability, the true number of chronic pyelitides is much larger than one would suspect as the difficulties in the way of proof are very great. In view of the tenacity with which infectious processes persist in the urinary tract, even when treated actively, the relationship between previous infection and exacerbation is important, though very difficult and unsatisfactory to establish definitely. Some writers have laid great stress upon the importance of previous urinary infections as an antecedent to pyelitis of pregnancy, even going so far as to state that pyelitis of childhood may provide a form of persistent chronic infection not obvious until pregnancy provokes an acute phase. However, we do know that the pregnant state affords many a chronic urinary infection with the necessary circumstances to bring about its exacerbation. What these factors are and how they operate we shall attempt to make clear in a consideration of the etiology of the disease.

ETIOLOGY

The two major factors necessary for the development of the disease are urinary stasis and the entrance of bacteria into the upper portions of the tract.

Urinary stasis is a common accompaniment of pregnancy. Due to muscular atony of the tract, the weight of the pregnant uterus upon the bony pelvis, as well as dextrotorsion of the uterus, there is produced a definite urinary stasis from the pelvic brim upwards which, in about 80 per cent, produces some degree of hydroureter and hydronephrosis. In the great majority of gravid women, therefore, the introduction of a sufficient number of bacteria is all that is necessary to produce the inflammation of the walls of the ureter and kidney pelvis which we designate pyeloureteritis of pregnancy. Apparently

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there are other factors, however, which though taking a minor part, seem to have some influence on the development of the disease. Not all women with stasis and urinary infection of the upper portions of the tract develop clinical pyelitis. Immunity to certain types of microorganisms seems to play a role. Were this not true pyelitis in pregnancy would occur with much greater frequency. Unfortunately, we do not yet know how to influence the factors causing immunity, so we must content ourselves in the treatment of the disease by combatting stasis on the one hand and the infection on the other.

Fig. 1. Pyeloureterogram following intravenous injection of neoskiodan, in a normal nulligravida. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

Fig. 2. Intravenous pyelogram illustrating the changes in the ureter usually associated with pregnancy. The kidneys are normal. Both ureters are dilated and elongated, the right more than the left, and are displaced laterally. These changes may be considered as normal. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

The causative organism which is responsible for over 90 per cent of the incidence of pyeloureteritis is the Bacillus coli. Occasionally it is attributable to a streptococcus or a staphylococcus but more often these are seen in association with the Bacillus coli.

There still remains much that is unexplained in accounting for the means whereby these organisms reach the kidney pelvis and ureter. The most obvious mechanism would seem to be ascent of the urinary tract from the vulva, urethra and bladder. Today there are those who still adhere to this explanation, pointing to cystitis and a supposed decompensation of the ureterovesical valves with retrograde reflux of infected urine, as all that is necessary to explain the infection of the upper ureter. Unfortunately the truth does not appear to be quite as simple as this theory would lead one to expect, for cystitis is not at all necessary or, indeed, a common precursor of ureteritis, and investigation reveals that the vesical valves are quite as competent in pregnancy as in the nongravid woman. This theory, then, is more or less untenable.

From the evidence at hand, it seems much more likely that the infective micro-

organisms are carried to the ureter, kidney pelvis and renal capsule through lymphatic channels. Francke has demonstrated the possibility of bacterial transfer from the colon to the capsule of the right kidney, while others have pointed out the frequent association seeming to exist between chronic appendicitis, constipation and chronic gallbladder disease on the one hand, and pyelitis of pregnancy on the other. In view of the fact that there is seldom any febrile reaction preceding that stage of the disease in which there is widespread invasion of the ureteral and renal pelvic tissues, and whereas bacteremia is nearly always associated with a marked rise in body temperature, we feel inclined for these and many other reasons, to favor the lymphogenous route as that most suitably explaining all the known facts pertaining to primary urinary infection of the upper tract in pregnancy.

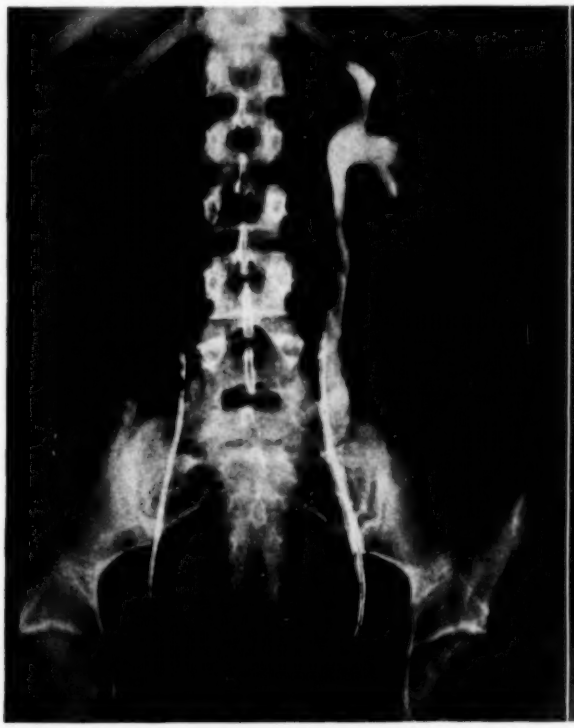

Fig. 3. Retrograde pyelogram taken in the seventh month of pregnancy showing moderate hydronephrosis and hydroureter. This degree of dilatation is not at all uncommon. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

Fig. 4. Three week postpartum, illustrating involution in the ureter and renal pelvis. Though the process is not complete it has changed a marked hydronephrosis and hydroureter to nearly normal dimensions. This is what may be expected when infection does not produce edema and fibrosis. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

In the puerperium, there is the additional etiologic factor of trauma. Trauma of the base of the bladder involving the lower ureters is concomitant with many deliveries. This results in edema and increased stasis which undoubtedly is of great importance in accounting for postpartum pyelitis.

HISTOLOGICAL FEATURES

In the acute phase, the microorganism produces an inflammation of the internal aspects of the ureter and kidney pelvis, with swelling and edema accompanied by an outpouring of leucocytes, many of which accumulate on the mucosa in the form of an exudate. When these become detached they float away in the urine and are the "clumped pus cells" so characteristic and

pathognomonic of pyelitis. Later the submucosa and muscle layers become involved with all the concomitants of an inflammatory reaction. When the process is prolonged, the connective tissue elements appear and become organized into structures which at first are loosely arranged, but which later produce the condition known as fibrosis. As this connective tissue becomes organized, its density and rigidity increase and often result in so fixing the muscular structures in a rigid scar that even after the inflammation has subsided the contractile elements may be unable to produce the peristaltic propulsion necessary to the normal excretory activity of these tracts. Thus the end-result may be a complete or partial embarrassment of the kidney pelvis and ureter, or the woman may be left with a permanent chronically infected hydroureter, and impaired health as a prospect for the future. It is exceedingly rare that a patient having an infected ureter or ureters can be cured of that infection during pregnancy. The atonic ureters with their content of static urine provides too ideal a background for the progress of the disease to allow of a complete cure even though, fortunately, many of the more acute clinical evidences of the disease may and usually do disappear with suitable therapy. Indeed, it may be accepted as a safe point of view that *the pregnant woman is not cured of pyeloureteritis during pregnancy*. She harbors the disease which may, and often does remain quiescent but frequently reappears later in pregnancy, in the puerperium, or even in a subsequent pregnancy.

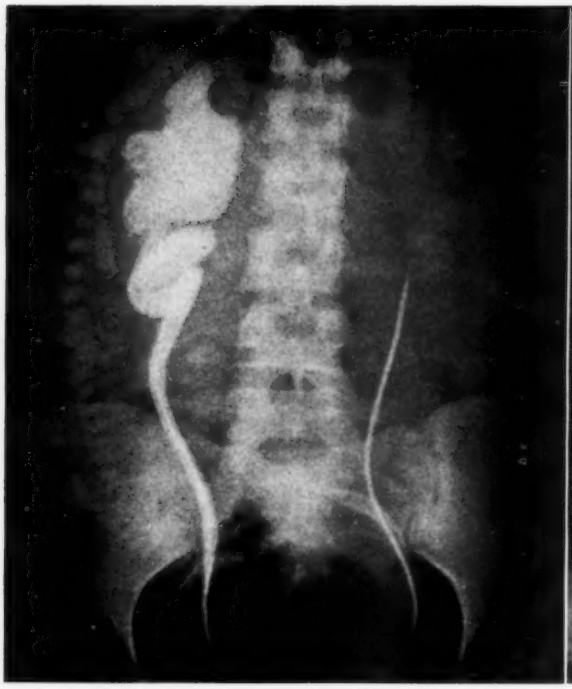

Fig. 5. Retrograde pyelogram taken in the eighth month of pregnancy. The patient, a multipara, suffered from pyonephrosis which had its origin in hydronephrosis of pregnancy. This kidney and ureter had a capacity of 85 c.c. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

Fig. 6. Postpartum complication; a persistent bilateral pyonephrosis in the puerperium, which had its origin in pyeloureteritis of pregnancy. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

This knowledge which is supported abundantly by all students of the disease points to the importance of early recognition, correct diagnosis and adequate treatment of the disease in the antenatal as well as the postnatal periods. In addition, it emphasizes the necessity for a knowledge of prophylactic measures.

CLINICAL FEATURES

Acute pyeloureteritis is usually accompanied by a marked elevation of temperature. This frequently is hectic in type and when it is sufficiently high it is often accompanied by chills. The pulse rate is accelerated, and anorexia, nausea and vomiting, are often seen. There is usually pain, or at least demonstrable tenderness, in the costovertebral angle corresponding to the side of the affected kidney. Upon deep inspiration exquisite tenderness of the descending kidney may be elicited.

On some occasions a considerable degree of abdominal distention may be associated with the kidney infection and be quite misleading.

Examination of the urine usually shows bacilluria and pyuria, the pus cells being in the familiar clumped formation. However, absence of positive urinary findings does not rule out pyelitis in all cases, for occasionally the lower portions of the ureter may become clogged with inspissated pus so that drainage is precluded.

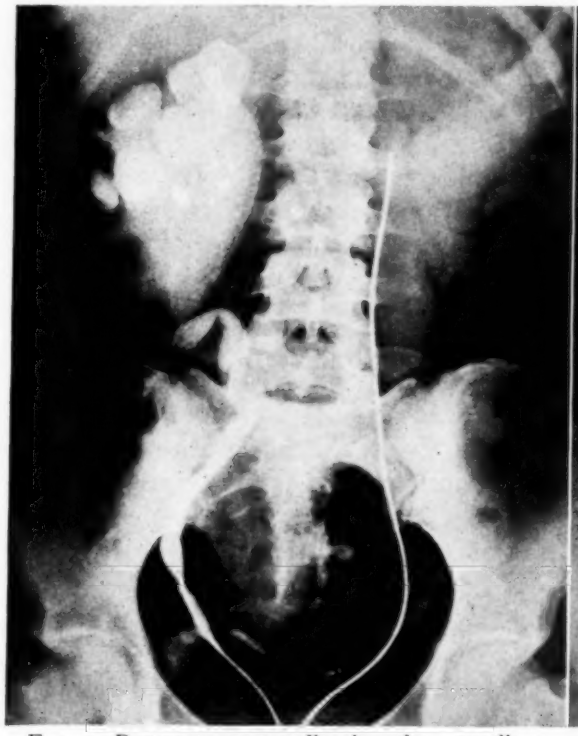

FIG. 7. Postpartum complication; longstanding hydronephrosis which had its origin during pregnancy. Despite the fact that months have elapsed since the termination of the pregnancy, this tract has failed to recover its normal function. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

FIG. 8. Postpartum hydroureter nine months after delivery showing a partial but incomplete recovery of contour and function. Probably this is the end of the process. Such a tract is prone to harbor the infection and to recrudescence in subsequent pregnancies. (Stander. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

Usually the febrile phase of the disease runs a short course when well treated. On the other hand, one occasionally meets a patient in whom the disease has extended beyond the kidney pelvis and involves the parenchyma of the organ. It is impossible to determine clinically between simple pyelitis and pyelonephritis except by examining the blood for its content of nonprotein nitrogen constituents. As pyelonephritis carries with it a much more dangerous prognosis, this simple procedure is of the greatest importance. One cannot impress too forcibly the necessity of its being done on every patient who suffers from pyelitis in the febrile phase. When a

markedly elevated non-protein nitrogen content of the blood stream is present, the treatment should be radical and prompt.

TREATMENT

The treatment of pyeloureteritis has undergone marked changes in recent years, particularly in regard to the postnatal period. In the antenatal and postnatal acute phase efforts are concentrated to reduce stasis of urine so that bacterial growth and absorption of toxic elements may be reduced. This is accomplished by rest in bed with emphasis upon relieving weight from the affected ureter or ureters, purgation, bland diet, forced fluids and high intake of alkalinizing substances such as sodium bicarbonate. In the postpartum period one may have great success with the so-called ketogenic diets of either the high fat or starvation varieties. More recently mandelic acid salts have been employed by mouth with good result. The ketogenic diets as well as the mandelic acid therapy must be pushed to a degree which will keep the urine at a *p*H of 5.6 or below. This requires daily testing specimens of the total urine output.

Occasionally in resistant cases, catheterization with lavage of the affected tracts may be necessary and infrequently the indwelling ureteral catheter may be used to advantage.

Usually the patient responds to treatment and passes the acute phase in a few days, but unfortunately, we too commonly consider this the sequel to the syndrome. This is not borne out by recent studies. It has been shown beyond any question that the patient requires much time and frequently great care and protracted treatment to rid her of the infection. Thus the postnatal care of pyelitis of pregnancy has come to assume tremendous importance in the minds of all careful obstetricians.

Postnatal care involves frequent catheterization with dilatation of the fibrosed portion of the ureters, particularly of the lower or pelvic portions, associated with lavage of the renal pelvis and ureter with mild antiseptic solutions such as silver nitrate, 1:1000 dilution. Accompanying this, careful records as to bacterial culture of the ureteral urine are required as an index to the disappearance of the infection. Obviously this requires the facilities of a well equipped hospital.

In general, this treatment is adequate for the average unilateral case of pyeloureteritis. However, should the disease be bilateral, particularly in the first two trimesters of pregnancy, or should examination of the blood show retention of nitrogenous products, a more radical course is indicated. Usually this should begin by terminating the pregnancy. This may seem unnecessarily radical, but lack of observance of this rule has been one of the chief sources of acute disappointment. Our only experiences with death and prolonged illness have been associated with its non-observance.

END-RESULTS FOR THE WOMAN AND CHILD

Whatever the factors involved may be in causing infection of the urinary tract in pregnancy, they often persist beyond the single pregnancy to reappear in subsequent ones. Thus we may say that once infected, there is always danger of recurrence.

In a few of those patients who are not discovered until too late, or who do not receive adequate care, such a degree of fibrosis of the ureter and kidney pelvis results that permanent hydroureter and hydronephrosis may follow.

Pyelonephritis, meaning extension of the inflammatory process into the glandular portions of the kidney, is an ever present possibility. Our mortality from this phase of the disease has been nearly 3 per cent of all cases of pyelitis.

Infantile mortality is much higher when the mother suffers from pyelitis. Abortion, prematurity and stillbirth are common, and even when born alive the infants often succumb neonatally. This accounts for a fetal mortality of 10 per cent as compared to a total clinic fetal mortality of 3.3 per

cent. Thus the expectancy for obtaining a nonviable infant from women suffering from pyelitis of pregnancy is three times as great as in the normal pregnancy. This perhaps should influence us very definitely when considering long palliation in the refractory case toward earlier evacuation of the uterus.

PROPHYLAXIS

Our antenatal care of expectant mothers should be just as thorough as regards the acute infections of the urinary tract as it is in the instance of the toxemias. We should be alert for the first symptoms of dysuria, hematuria, flank or costovertebral pain, and when clumped pus cells are found in the urine, the active treatment for the disease should be instituted. This should include confinement to bed, forced fluid intake, bland diet and purgation. Should the characteristic hectic fever be present, the patient should be confined to bed until the temperature has been normal for seven days. Subsequently, we should bear in mind that the infection will not, in all probability, disappear during pregnancy, so that a strict watch must be maintained for exacerbation of the disease.

In the puerperium the patient must be followed by urological examination until the urine culture proves repeatedly that it contains no viable pathogenic organisms. Obviously, further pregnancies should be averted until such time as the mother has completed her convalescence. In the majority of patients receiving good care, this may be accomplished in a few months; in others, it may require a year or more. A few patients will be seen who cannot be freed of the chronic infection, even after prolonged and careful treatment, when this is associated with hydroureter or hydronephrosis.

CONCLUSIONS

It is difficult to summarize what has been said concerning pyelitis in pregnancy because the consideration, as given, has been condensed to its simplest terms. However, it may be of value to reemphasize some of the most important points.

1. Contrary to common belief, pyelitis in pregnancy is of fairly frequent occurrence, being often mistakenly diagnosed as intrauterine infection, particularly in the puerperium.

2. Upper urinary tract infection is so rarely cured during the gestation period that though the clinical symptoms subside, vigilance and constant care are necessary to guard against recurrence.

3. Extension of the infection into the glandular portions of the renal cortex with the development of pyelonephritis is to be constantly guarded against because of its serious implications. The only clinical test which assists in the differentiation between pyelitis and pyelonephritis in the early stages is the non-protein nitrogen content of the blood. It is important that this test be utilized in all patients who do not respond promptly to conservative treatment.

4. Pyelitis of pregnancy is associated with three to four times the fetal mortality accompanying ordinary obstetrical experience.

5. The puerperal woman having had pyelitis must be treated until the urine from both kidneys is bacteria-free before another pregnancy is allowed to occur.

6. Bilateral pyelitis is of much more grave prognosis than unilateral disease. If the clinical symptoms do not respond to treatment within five or six days, or if there is an elevated non-protein nitrogen content in the blood, the danger to the mother is usually so great that continuance of the pregnancy is unjustifiable.

7. Finally, the incidence of pyelitis in pregnancy can be greatly reduced by prophylactic care in the antenatal period.

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SYPHILIS IN PREGNANCY*

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IN women the initial lesion of syphilis is more elusive than in man and unless seen on the vulva usually is unnoticed. Levenson and Goldenberg,[1] in 465 recently infected women, failed to find even a scar of a chancre on the genitals. The secondary manifestations, likewise, are often unnoticed. Skin eruptions are mild and disappear rather rapidly; on the other hand, the presence of condylomata lata may cause the patient to consult her physician. It is the history of the previous pregnancies that is most significant. Only 217 of the 310 gestations which occurred in the 76 patients herein studied went to term, while 93 terminated either in miscarriage or the birth of syphilitic infants.

TABLE I

HISTORY OF PREVIOUS PREGNANCIES

Total pregnancies	310
Full term living infants	217
Full term living infants who died early in life	21
Full term stillbirths	18
Premature living infants	5
Premature living infants who died early in life	3
Premature stillbirths	9
Miscarriages	68

Abortion in the first trimester is noted but slightly more frequently than in ordinary pregnancy; on the other hand, interruption of pregnancy at the fifth, sixth and seventh month is common.

From the foregoing, it is evident that syphilis complicating pregnancy in a primigravida seldom is recognized until the damage is done, unless the practice of making routine serological examinations is followed. This conclusion corroborates that made in our clinic in 1926[2] when a study of 144 pregnant syphilitic women was reported. Only 6 of the latter gave evidence of a primary lesion, while the history and physical examination were suggestive in but 34 of the patients in the series.

At the time of admission to our clinic, blood for the Wassermann and Kahn tests is taken. If it is found to be positive or questionable, the tests are repeated in order that laboratory error may be eliminated. Should the reaction be strongly positive, treatment is inaugurated even though no other evidence of syphilis is found. Treatment, likewise, is given to all patients with a definite history, even though the Wassermann may be but mildly positive.

When a suspicious history is accompanied by a negative or questionable Wassermann, 0.3 gm. neosalvarsan in 10 c.c. of freshly distilled water is injected intravenously and blood is taken for the Wassermann test one, four and eight days subsequently. If, after this provocative injection, the reaction is strongly positive, the patient receives the routine antiluetic treatment. In a recent case, this provocative measure definitely revealed syphilis in the mother, and, as a result of these observations, the disease was also discovered in her husband and two other children, all of whom were unaware of infection.

TREATMENT

During pregnancy, treatment is given primarily in the interest of the child, and fortunately the chance of obtaining a good result in this respect is excellent. All who are experienced in the use of arsphenamine for this purpose, agree that comparatively few injections have a most marked effect upon fetal syphilis. This drug, accordingly, has proved itself to be a worthy adversary

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of the archdestroyer of fetal life. How these remarkably good results have been obtained has not been explained, aside from the observation that relatively large amounts of arsenic have been recovered from the meconium, which proves that arsenicals pass through the placenta and reach the unborn child.[3] For some unexplained reason, their potency as spirocheticides seems to be much greater in fetal than in mature tissues, as is shown by the fact that even though the Wassermann may remain positive in a well treated mother, her child often is born free from syphilis.

Naturally, the earlier in pregnancy treatment is inaugurated, the better will be the results for both the mother and the child, and our aim should be to secure a negative Wassermann as soon as possible. We accordingly should start the treatment immediately after the diagnosis is made in the hope that this desired effect may be obtained. The fear that arsphenamine might cause a miscarriage formerly led many conscientious physicians to avoid its use during pregnancy. However, those who had the courage to treat all cases of pregnancy syphilis vigorously, soon found that it was the disease and not the treatment that caused these interruptions of gestation. Pregnancy, therefore, is not a contraindication but a strong indication for the vigorous use of arsenicals in the fight against congenital syphilis.

Even though circumstances prevent early treatment, the use of arsphenamine as late as the third trimester often is productive of extraordinary results. Inadequate as the treatment may be, stillbirths frequently are thus prevented, syphilis in the surviving children usually is rendered less innocuous and more easily controllable, and, occasionally, a child is born without any evidence of the disease.

Although pregnancy syphilis was treated in our clinic as early as 1919 by intravenous injections of salvarsan, the mentioned generalizations were made possible only by the accumulated experiences of the years that followed[4] and, as a result, early in 1934, the following routine was devised: Three-tenths gm. of neosalvarsan (neodiarsenol) in 10 c.c. of freshly distilled water is injected into the basilic or cephalic vein. If this is well tolerated, the dose is increased to 0.6 gm., and is repeated weekly. In addition, 1 c.c. of 10 per cent bismuth salicylate in oil is given intramuscularly into the buttocks two days before each intravenous injection of the arsenical. There are no so-called courses, nor are there rest periods. The treatment with both bismuth and neosalvarsan accordingly is repeated at weekly intervals continuously from the time of the first injection until the child is delivered.

Prior to each neosalvarsan injection, the blood pressure is taken and the urine examined for albumin. If any evidence of toxemia is present, the arsenical is withheld until all toxic signs have disappeared. In case of doubt, the treatment is not given. That the use of this drug is not without danger is shown by the fact that 3 of our cases died as a result of arsenical poisoning. These, however, occurred before the responsibility for the treatment of pregnancy syphilis was taken over by our prenatal clinic. With the inauguration of the described routine all cases of syphilis which have been discovered in our prenatal clinic have been treated by one of the members of our staff. As a result, early toxic states have been recognized, and a repetition of these unfortunate arsenical accidents has thereby been prevented.

To the 76 patients who form the basis of this report, 717 injections were given without any serious complication. One woman, however, developed an exfoliative arsenical dermatitis which slowly disappeared after the injections were discontinued.

END RESULTS

Two of the patients included in this series received no treatment. The beneficial effect of arsphenamine in the remaining 74 is shown in Table 11. Only 2 infants were

stillborn, and both of these were obstetric deaths. In one a craniotomy was done, and in the other, the child had hydrocephalus. Twenty infants of the remaining 72 showed some signs which were suggestive of syphilis. Sixteen of these, on *x*-ray examination, revealed the characteristic long bone changes of lues. Of the 20 bad results, 13 occurred in women who had received less than ten injections of arsphenamine.

TABLE II
END RESULTS OF TREATMENT

Injections of Arsphenamine	Total Cases	Stillbirths	Living Infants with Syphilis	Living Infants without Syphilis
25–30	3	1 (hydrocephalus)	1	1
20–25	3	1 (craniotomy)	1	1
15–20	8	0	1	7
10–15	18	0	4	14
5–10	23	0	6	17
1–5	19	0	7	12
Total....	74	2	20	52

SUMMARY

1. In women, the primary and secondary manifestations of syphilis often are unnoticed.

2. The history of previous pregnancies is significant.

3. The routine serological examination is most important.

4. A provocative injection of neosalvarsan occasionally reveals latent syphilis.

5. Pregnancy is a strong indication for the vigorous treatment of syphilis with the arsenicals. Even if the patient with pregnancy syphilis is first seen late in gestation, she should be treated.

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HEART DISEASE IN THE PREGNANT WOMAN*

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STUDY of the problem of what to expect from and what to do for women with heart disease if they become pregnant leads naturally to study of the demands normal pregnancy makes on the normal heart and circulation. Much appropriate study has been done for many years. Of late years this work has increased rapidly. To be sure, it is possible to say that we have found out merely what we knew at the start, that pregnancy produces more work for the heart and circulation. But in fact we have gained a great deal of fundamental knowledge. To give brief examples:

The cardiac output increases slowly at first, then rapidly, then begins to diminish for some reason at some time during the weeks before delivery, but does not complete its return to normal for several weeks after delivery. Likewise, and at the same time, the blood viscosity and hematocrit fall and rise and the blood volume rises and falls.

Following is a chart illustrating graphically some of these phenomena made at my request by Dr. K. Jefferson Thomson, Boston Lying-In Hospital, Boston, based largely on results of work done by him and Drs. George P. Robb, Mandel E. Cohen and A. Hirsheimer at this hospital. The curve showing cardiac output is made from information furnished by Dr. C. Sidney Burwell of Boston, from work done by him and his colleagues.

The reality of the vague clinical phenomenon of "lightening," or amelioration of breathlessness and other symptoms associated with the burdensome demands of pregnancy, which frequently appears in the last few weeks before term, is clearly indicated. Now this lightening occurs *before* delivery and there is no evidence of a critical lessening of the burden of normal pregnancy on the circulation immediately after delivery. This important fact should be known to any clinician dealing with bad risk patients in pregnancy. To be sure, before we had experimental data, we found out from directly observing cardiacs in pregnancy that congestive heart failure was most apt to occur during the seventh and eighth months of pregnancy and that it occurred comparatively rarely in the ninth month (Table 1). The curve showing

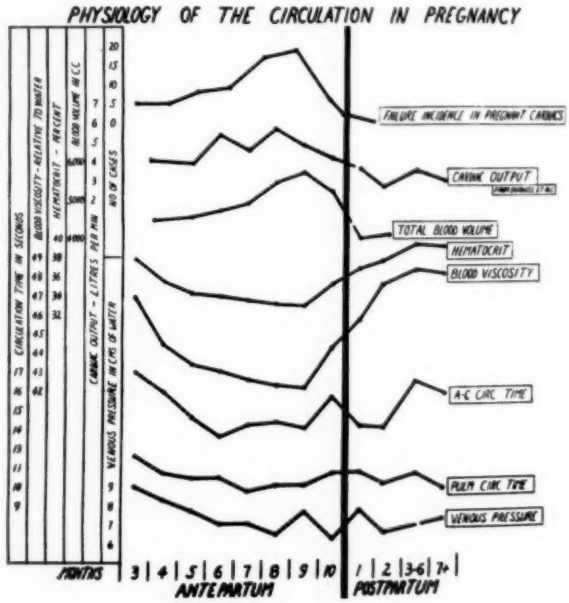
PHYSIOLOGY OF THE CIRCULATION IN PREGNANCY
CIRCULATION TIME IN SECONDS
BLOOD VISCOSITY - RELATIVE TO WATER
HEMATOCRIT - PERCENT
BLOOD VOLUME IN CC.
CARDIAC OUTPUT - LITERS PER MIN.
VENOUS PRESSURE IN CMS OF WATER
NO. OF CASES
FAILURE INCIDENCE IN PREGNANT CARDIACS
CARDIAC OUTPUT
TOTAL BLOOD VOLUME
HEMATOCRIT
BLOOD VISCOSITY
A-C CIRC. TIME
PULM. CIRC. TIME
VENOUS PRESSURE
MONTHS
3 | 4 | 5 | 6 | 7 | 8 | 9 | 10
ANTEPARTUM
1 | 2 | 3-6 | 7+
POSTPARTUM

TABLE I.

the incidence of congestive heart failure among cardiacs during the course of pregnancy follows closely the curves of the observations on the activity of the circulation and the total volume of blood. And we observed that emptying the uterus of a pregnant woman in heart failure did

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not result in much immediate relief. But these observations, convincing enough to those who made them, could not easily be supported by specific recorded observations. The physiological studies have made them convincing and emphasized their importance.

It would be wrong, however, to think that physiological experiments can select good from bad risks among cardiacs or that they can show us clearly how to control or to deliver our cardiacs. The only convincing way we can learn these essential matters is from study of the direct experiments that women with heart disease who undertake pregnancy offer. For fifteen years we have studied such women at the Boston Lying-In Hospital. Following are some of the things they have taught us.

From 5 to 10 per cent of all the pregnant women have something in the history or physical examination to make the routine examiner wish for a special opinion concerning the ability of the patient's heart to stand pregnancy, and they are sent to the heart clinic. There these women fall naturally into three classes.

Class III. Those that have been referred because they have complaints suggesting heart disease but have no clear evidence of cardiac pathology.

Breathlessness. In some cases this is described merely as a consciousness of more or less increased breathlessness at accustomed tasks. Others describe brief, haphazard sensations of suffocation or desire to take a deeper breath than they comfortably can. Sometimes these sensations occur at night and waken the patients, causing considerable anxiety, thus falsely suggesting the severe paroxysmal dyspnea attacks that some cardiacs have. But they differ from these dangerous attacks in that (1) they are never accompanied by "asthma" or cough or hemoptosis; and (2) they are of brief duration. During the latter months of pregnancy, pregnant women usually use more pillows to enable them to breathe comfortably. Description of this may falsely suggest an orthopnea due to cardiac failure. With or without any of these symptoms, many pregnant women are conscious of the heart beat and feel that the heart is beating harder than usual. Haphazard pain in the region of the heart or below the left breast, usually mild, sometimes severe, is a common complaint. These symptoms may be considered normal accompaniments of pregnancy.

Giddiness, blurring of vision, faintness, even *fainting,* may accompany some or all of the above symptoms. They are common symptoms also among neurotic people. Sometimes the pregnancy patients complain of other symptoms found among cardiac neurotics or neurocirculatory asthenics, if one likes to attempt to make this distinction, and suffer apparently severe degrees of disability from them and show poor response to ordinary effort tests. *But if such patients do not show clear signs of cardiac damage on direct examination, they are safe risks.* No one who has been classified in Class III has ever developed heart failure in pregnancy.

Class II. Many pregnant women show the following troublesome signs on examination of the heart: (1) systolic murmur, usually at the base, sometimes loud; in some cases it is so loud that even after years of experience the murmur disturbs us; (2) third heart sounds at the apex; (3) a widening of the transverse diameter of the heart in the seven-foot *x*-ray plate so that it is slightly more than one-half the internal transverse diameter of the chest, falsely suggesting a pathological enlargement; and (4) *x*-ray study may also show increased lung markings suggesting pathological congestion falsely simulating congestive heart failure. *These may be considered normal accompaniments of pregnancy.* If a woman shows these but no signs that mean unmistakable evidence of heart damage, she will not develop heart failure during pregnancy.

Class I. If, however, a pregnant woman has on direct examination either (1) *a diastolic murmur,* or (2) *an unmistakable*

enlargement of the heart, she may develop heart failure during pregnancy at any time. Approximately 20 per cent of Class 1 cardiacs have shown congestive heart failure.

It appears that we can select in pregnancy those women who cannot develop heart failure during pregnancy and those who may at any time develop it by simple direct examination of the heart. And such is the case. Exceptions to this rule are extremely rare, and are of such a nature that they do not detract from the soundness of the rule; for example, rare cases who have bacterial endocarditis or congenital ventricular septal defects.

The classification as above that we now follow was taught us by the patients, not preconceived and applied forcibly to the patients.

Approximately 2.5 per cent of all the pregnant women at the Boston Lying-In Hospital are Class 1 cardiacs. Many of these are sent there because they are known to be cardiacs, and who would, if not cardiacs, be delivered elsewhere, and it is likely that the percentage of Class 1 cardicas is twice as high in the Boston Lying-In Hospital as among pregnant women in the whole community.

Among the 20 per cent of Class 1 cardiacs that developed congestive heart failure in the first 500 Class 1 cardiacs delivered, approximately 25 per cent died (Table 11). Before the last three years these deaths in and entirely due to congestive heart failure account for approximately 60 per cent of the fatalities among the cardiacs and congestive heart failure was one of the fatal factors in approximately 20 per cent more.

Let us study a series of fatal cases. They may be regarded as costly experiments freely afforded us. If we study them intelligently enough we should find the secret of why they died and learn ways to prevent the death of similar cases.

The following table presents 42 fatal cases among Class 1 cardiacs in pregnancy or puerperium.

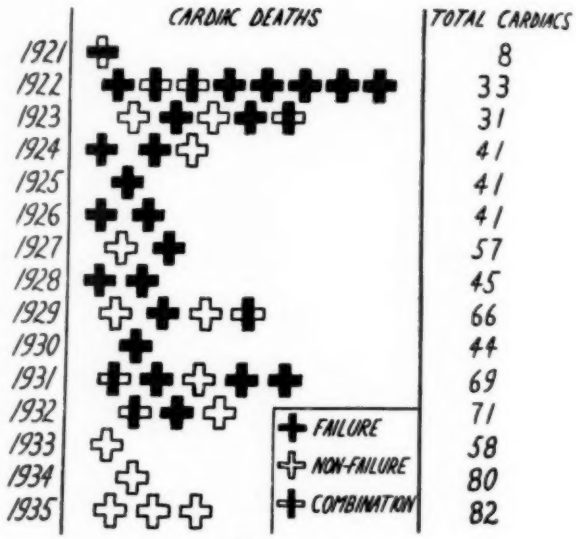

Table 11.

The simplest study shows:

There was a high incidence of deaths in congestive heart failure during the first years. This incidence dropped, then rose a little, then fell.

The total death rate for the first 250 cases was 7.6 per cent.

The total death rate for the second 250 cases was 5.2 per cent.

The total death rate for the third 250 cases was 2.8 per cent.

For the first three years we studied the patients greedily. We wondered at first if recurrence of active rheumatic disease during pregnancy might not cause congestive heart failure in many cases. Although more than 90 per cent of our Class 1 cardiacs had chronic rheumatic heart disease, almost no patient developed active rheumatic disease during pregnancy. We promptly encountered deaths in congestive heart failure. No one knew which cardiac patient would have congestive heart failure and die, or why or how failure and death might occur. We studied the history of cases that showed congestive heart failure and died, and found that nearly always the patient had (1) overexerted, (2) become overfatigued, or (3) had caught an infection and had tried to carry on in spite of it. And if these factors were not clearly present, the patient had previously had congestive

heart failure or had auricular fibrillation or both.

We were taught the following rules:

Congestive heart failure may occur suddenly or gradually. The first reliable sign is persistent rales at the bases of the lungs. To catch the failing cases early we must examine them frequently, once a week, at least. We must instruct and convince them that they must report at once if they have a cold or cough, or spit up blood, or become increasingly breathless. If they have once failed they must be kept in the hospital or under hospital conditions until delivered. If we disobeyed this rule, as we sometimes did, and let them out to resume conditions approximating the conditions under which they had previously failed, they were most likely to develop congestive heart failure again.

From this experience appeared the essentials of present modern treatment of heart disease in pregnancy. Refinements and improvements in our methods of handling individual cases continue to appear, but the big drop in the death rate occurred when we found out that,

1. A group with whom pregnancy was not compatible, which we called Class 1-a, namely, those that had once had congestive heart failure, those that had auricular fibrillation. No amount of refinement of treatment can be expected to enable groups of such cases to yield a really low death rate in pregnancy. They should be warned against pregnancy. We should advise interruption if they report to us early in pregnancy.

2. Any Class 1 cardiac may develop congestive heart failure at any time during pregnancy. Therefore we must accord them special continuous medical supervision designed (1) to prevent congestive heart failure; and (2) to recognize it early and to start suitable treatment.

The maternal death rate among cardiacs who have not previously had congestive heart failure and who have a normal heart rhythm is low. It is not practical to try to subdivide the group beyond this point. To be sure, patients with uncomplicated mitral stenosis who have regular rhythm, and have never failed, and are thus all Class 1 cardiacs differ from one whose only sign of disease is a mitral diastolic murmur heard only after exercise, with the patient recumbent, to one whose heart is enlarged, and has a full mitral diastolic murmur heard at any time in any position. But there is no useful dividing line between the extremes in this group. We do know that an individual with uncomplicated mitral stenosis who is more than thirty-five years of age takes twice the chance of having congestive heart failure in pregnancy as does one less than thirty-five years old. But the important thing is that every one of the Class 1 cardiacs has definite heart disease and may develop congestive heart failure during pregnancy and must take precautions suitable to her as an individual to prevent such disaster.

The maternal death rate dropped from approximately 12 per cent to approximately 3 per cent when we found out and effectively applied these rules. It rose during a period when application of our knowledge diminished because of changing personnel in the social service and heart clinic. It has dropped to a new low during the last few years. Indeed for three years in 220 cases we have not had a death due to congestive heart failure among our cardiacs. Heart failure deaths have tended to disappear from the wards of this hospital as deaths in diabetic coma and pernicious anemia have disappeared largely from the wards of the general hospitals. Although the change in treatment and consequently, in the prognosis of the cardiacs has been less dramatic than the change in the treatment and prognosis of patients with pernicious anemia and diabetes, it is just as decisive.

What is the death rate in pregnancy for Class 1 cardiacs? Death in and from congestive heart failure is the greatest danger, but deaths from congestive heart failure are preventable. The remaining deaths among cardiacs, excluding the rare death from

toxemia, bleeding, sepsis, intercurrent infections, and other possible causes which may effect any pregnant woman, are supplied by bacterial endocarditis or pulmonary embolism. Nearly 2 per cent of all the Class 1 cardiacs die from pulmonary embolism or bacterial endocarditis. Fatal pulmonary embolism is many times as common among the Class 1 cardiacs as among normal women. Pulmonary embolism may occur more commonly among Class 1 cardiacs, or they are less able to survive it, or both, as seems likely. Class 1 cardiacs are of course more or less vulnerable to bacterial endocarditis, and we have found it in just under one per cent during the time of their pregnancy and puerperium. These fatalities are not preventable. It may be fairly said that the *death rate for Class I cardiacs in pregnancy should be roughly 2 per cent; but will be more, up to at least 12 per cent, if correct treatment is not provided and accepted.*

TREATMENT OF CLASS 1 CARDIACS

Now it is a real art to direct any Class 1 cardiac through pregnancy safely and to avoid unnecessary restrictions. My experience leaves me no chance to question that the success of the cases varies directly with the skill and attention of the physicians in control. The cooperation of the patient is essential, but uncooperative patients become rarer and rarer with the increasing experience of a physician.

I have attempted many times to outline the routine care of a cardiac in pregnancy. Though each time the results seem clearly inadequate, it seems also clear that the more one systematizes the points that are important, the more thoroughly instructed and the more safely guarded is the patient, and in the long run the fewer the casualties and the fewer the deaths.

Each case is a special problem, but let us discuss the amount of daily work suitable for a young primipara with mitral stenosis, no enlargement of the heart, a normal rhythm, no cyanosis, no history of failure, a history of reasonably normal activity without disability, no complicating physical defects, fair musculature and development. How much activity is safe for her? It may help in giving advice to regard such a patient as fifteen years older than her actual age. This is perhaps not far from the difference in expectation of life for the average young Class 1 cardiac and a normal comparable individual. During the first two trimesters she may walk reasonable distances to which she is accustomed. But she must not walk to shops and stand around for long periods, walk back with bundles, and then take up her routine home activities. Many congestive failures have definitely followed long shopping trips, and a rule of "no shopping" undoubtedly saves many failures. She may go over stairs, but it is well for her to keep count of the number of flights daily and limit them to some suitable number, say four. Except for very moderate, short, regular walks, she should give up all exercise and never be tempted, for example, to swim, to play golf or tennis. She may safely continue work as a secretary, or do light manual work, knitting, painting, artistic work, or light housekeeping. But she should give up store work or work that similarly requires standing, frequent walking, hurrying and lifting.

Whatever she does, she must make up for her daily expenditure of energy by having at least nine hours in bed out of every twenty-four, and at least one hour extra lying down in the middle of the day. She must keep these rules whatever the temptation to break them. Therefore, the common events that tend to disrupt them should be anticipated and suitably planned for,—moving to or from summer cottages, house cleaning, busy week-ends, holiday or other fatiguing entertainments, visits of relatives or friends, sickness in the family. All of these conditions have directly caused congestive heart failure in cases I have seen.

She must learn to treat every infection as a major illness. The rule is, "Bed at the onset of any illness and call your physician." This possibility should be planned for. Someone must be available who can

take on the necessary work if the patient has to go to bed. The usual epidemics of infections that have affected the cardiacs at the Boston Lying-In Hospital during the last fifteen years have rarely caused disaster except in individuals who have attempted to carry on their usual work or even added to it because of coincident illness of other members of the family.

During the third trimester the burden of pregnancy increases markedly and remains heavy until close to term, when it begins to diminish slowly. It is during the seventh and eighth lunar months that congestive heart failure most frequently occurs. Clearly there must be further restrictions of activity and increase of rest at this time. The safest principle is for the patient to plan to stay at home and do only the lightest housework and add to her hours of rest for the last twelve weeks of pregnancy. Of course, suitable modifications of this rule, such as permitting the patient to be driven for a single purchase, or visit to the physician or dentist, theatre or church, are safe.

Though many other factors are of undoubted importance in guarding a Class 1 cardiac in pregnancy against congestive heart failure, experience indicates that control of the daily expenditure of energy as roughly outlined is of prime importance. Clearly, to give any individual a safe and practical daily regime requires close supervision of the patient. And for this reason alone the patient should report to the physician once a week throughout pregnancy. We have learned not to attempt to base our judgment of the patient's welfare at these visits on any rule of thumb based on some indirect test; but we question and observe her. If there are no disturbing changes in blood pressure, in pulse rate, in the color of the skin, in her breathing, and if the patient's report of how she feels and how much she has done is reassuring we continue her regime. If dissatisfied, we increase her rest.

It is particularly important at the regular weekly visits to recognize early signs of congestive heart failure.

EARLY SIGNS OF HEART FAILURE

Now rarely among pregnant patients with heart disease a sudden attack of paroxysmal dyspnea appears as what should be considered the first unmistakable evidence of cardiac danger. I have seen it in a few of the patients with hypertension and in a very few others with free aortic regurgitation. But it never occurs in uncomplicated mitral stenosis, and only very rarely in all the group with chronic rheumatic disease, constituting more than 90 per cent of our Class 1 cardiacs. It may occur in cardiovascular syphilis, but such cases are extremely rare. Angina is very rare indeed in pregnant women. Even rarer are the cases with a pulmonary or tricuspid valve disease, or a cor pulmonale, or other conditions which may cause failure of the right side of the heart. Heart failure in pregnancy as I have seen it occur in more than 200 individuals, is heart failure of the congestive type. Usually even when the failure is of mild degree, one can find not only *the all important persistent rales at the bases of the lungs* with or without additional evidence of pulmonary congestion (left heart failure) but one can demonstrate an overfullness of the neck veins when the patient is at rest, recumbent, with the jugular bulb slightly higher than the highest part of the precordium; and if the patient is not far along in pregnancy, and the size of the uterus allows satisfactory palpation one can find suggestive fullness, tenderness, or both of the region of the liver, signs attributable to right heart failure.

We have found and have frequently stated that the most useful clinical sign of congestive heart failure is persistent rales at the lung bases. This statement still holds in spite of elaborate efforts to find an earlier one that is clinically valuable. Estimation of circulation time, of venous pressure, scrutiny of the lung markings under the fluoroscope require elaborate procedures and do not yield clear information of practical value. It is difficult to disparage

the value of estimation of vital capacity. Undoubtedly in certain cases a drop in vital capacity can call attention to an otherwise easily overlooked early failure. But in fact, though we have frequently used vital capacity determinations in studying individual cases or in collect data, we do not use them routinely to warn us of early or threatened failure. The clumsiness of the apparatus used, the unaccountable variation that many patients exhibit in repeated tests tend to discourage us from continuing its daily use. And we can get along excellently without it. Even more objections are inherent to any effort tests known to us designed to anticipate clinical signs of heart failure. We distrust such tests, dependent as they are on many factors totally unrelated to the condition of the heart muscle. We tried effort tests on every patient at each visit for several years but discontinued them because we found no clear use for them.

In pregnant women recognizable congestive heart failure occurs suddenly more often than not. The patient feels no change and shows none in physical examination but following unusual activity resulting in fatigue or following some special exertion she may note breathlessness, cough, and then show the unmistakable signs of congestive heart failure on examination. The important thing is not minor changes in their condition, even if conceivably some method for gauging this accurately could be invented, but to see that every Class 1 cardiac follows her rules, and promptly reports unusual symptoms and comes regularly for examination and instruction. Not infrequently, the presence of rales at the lung bases is found before the patient has noted any subjective symptoms. This sign has stood the test of long experience and has honestly won its position as the earliest reliable sign of congestive heart failure in pregnant cardiacs.

During the last few years I have routinely studied the movements of the chest wall in forced respiration among cardiacs. Even the mildest pulmonary congestion seems to modify these movements in a given patient. But it takes the training of many observations on many patients to obtain much information from this method of observation. And the control of patients and the resulting reduction of disability and death that has been attained at the Boston Lying-In Hospital among cardiacs has been effected without this aid.

Undoubtedly sudden variations in weight, particularly, of course, a sudden gain of weight, is a sign which calls for close observation. It may indicate a beginning heart or kidney failure.

We should instruct our patients to report at once, and not to delay until the next routine examination if they

1. Develop a cold or any other illness;
2. Note increasing breathlessness at accustomed tasks;
3. Develop a cough or "asthma" or spit up blood;
4. Note unusual increase in weight.

The last three cover the only clear signs that the patient can observe that may mean congestive failure.

There is danger from emphasizing these rules alone that we make neurasthenics of some of our cardiacs. This danger should be explained to the patient. We tell each cardiac that the rules are not given because we feel that she may drop dead or that she is in imminent danger of heart failure, but because we have found that if patients with hearts like hers follow these rules they don't get into trouble. And if they neglect these rules they sometimes do get into severe trouble. Further, we tell them that cough or breathlessness does not necessarily mean serious failure, it may show that they have been doing a little too much or merely that they are tired or frightened but that it takes a stethoscope to find out if they are all right or need more rest. And if they need more rest, the quicker they find it out the less trouble for them. And we tell them that pain in the region of the heart, consciousness of the heart beat, occasional feeling of suffocation, or desire to take a deeper breath than they can, or giddiness,

blurring of vision, faint feelings, are harmless sensations of no consequence whatsoever. And if a patient becomes a neurotic, it is not because of what we tell her. She needs to know these things possibly to avoid becoming a neurotic and certainly to avoid becoming a sick woman.

OBESITY, ANEMIA, ORAL SEPSIS, MALNUTRITION, EXCESSIVE FLUID INTAKE

In individual cardiacs it can be shown that any one of these common extraneous burdens on a heart may be the determining factor in disability.

The diet should contain fruit, vegetables, meat and milk. It does not need to contain much fat and carbohydrates may be reasonably restricted. On this basis we have been able to maintain obese cardiacs in excellent condition and without gain of weight during pregnancy. We have even reduced weight in obese cardiacs during the first two trimesters of pregnancy, and kept it at the low point.

We are not satisfied with a red blood count of less than 4.5 million or a hemoglobin of less than 85 per cent, and with modern methods can nearly always attain these standards.

Forcing fluids on a cardiac is a dangerous thing. A Class 1 cardiac should never increase her fluids without advice and should be warned not to do so even if advised by some physician not familiar with her heart condition. Such advice is often given where there is a question of pyelitis and sometimes as a fancied help for a cold or other infection. Forty to forty-eight ounces of fluids daily is enough for the usual case.

How shall we deliver our Class 1 cardiacs? As a cardiologist, I have avoided giving advice in their own province to obstetricians and have avoided as much as possible commenting directly on the purely obstetrical factors in the care of pregnant women with heart disease. But I have followed closely the history of their obstetrical care for fifteen years; more closely than has any obstetrician whom I know and therefore feel no embarrassment for writing the following paragraphs.

It took several years of studying the cardiacs to show us that a patient who has not already shown signs of congestive failure does not often fail at or after delivery, operative or otherwise. And that successful treatment of pregnant women with heart disease depends in greatest measure on the care of the patient up to delivery. It is possible for patients to fail for the first time during operative delivery. For example, I have seen a woman well controlled till just before term who broke her regime in preparation for reporting to the hospital, probably thereby inducing fatigue. She entered the hospital with no signs of failure, but she reacted poorly to sedatives designed to insure sleep the night of entrance and tossed most of the night. Early in the morning she again reacted with restlessness to additional preoperative sedation and then tossed and struggled during the induction of inhalation anesthesia and was found in congestive heart failure during a restless, dyspneic, coughing, vomiting recovery from abdominal hysterotomy. Congestive heart failure has appeared in a few patients that I have seen during long labors. The remarkable thing, however, is that it occurs so seldom.

It took a good many cases before we found that a cardiac, when in congestive heart failure, did not immediately show relief consequent to the emptying of her uterus. We learned from this to bend our effort toward improving our failing cardiacs by medical treatment and not to deliver them to cure or prevent a failure. We also learned that abdominal hysterotomy with the patient in good condition, or even in congestive heart failure, was tolerated easily. And for years we dreaded to allow the cardiacs whom we thought had severely damaged hearts, particularly those that had already shown at some time signs of heart failure, to go into labor. The results were excellent. The chief objection to abdominal hysterotomy is sepsis. After

fifteen years, among 42 deaths in approximately 750 Class 1 cardiacs only 4 cases of more than 150 cesarean sections died of sepsis. But of the vast number delivered from below only one died of sepsis. How many deaths from heart failure did the hysterotomies save? We shall never know. At present many fewer hysterotomies are performed for cardiac indications. We are surprised at the ease with which many of the severely sick cardiacs tolerate labor. We are also surprised that some of the cardiacs who have had severe prolonged labors have not died, although there have been some apparently very close calls. Time may add more precise information but it will take a long while.

Is heart disease alone ever an indication for cesarean section? At present one must confess that there is no clear rule which can be stated and supported by facts. Nor would any rule based on any mass of statistics gathered from all available sources be convincing to us. Statistics must be affected by whether the labor or operative delivery was well conducted, on whether the patient was rested and well cared for medically. We shall see if we continue to avoid hysterotomies for cardiac reasons alone, in the course of time, how much trouble we get into from hard labors. There will not be much, but there will be some.

There is no doubt in my mind that the most skilled pre- and postoperative treatment, anesthesia, and obstetrical care at the actual delivery is desirable for cardiacs. Cardiacs in severe heart failure in labor are not a pleasant sight. Some that I have seen frequently return to my mind.

SUMMARY

Because of the scope of the subject, "Heart Disease in the Pregnant Woman," the article is itself necessarily essentially a summary. I have called attention to recent increased knowledge of the physiology of the circulation during pregnancy learned from the work of others. I have briefly described some of the points taught me by my continuous study for fifteen years of women with heart disease at the Boston Lying-In Hospital.

1. The general classification of those suspected of heart disease and the criteria for selecting those who have significant heart disease (Class 1 cardiacs).

2. A series of 42 fatalities occurring among more than 750 Class 1 cardiacs is discussed. The death rate has fallen with increasing knowledge, and the application of this knowledge, to what is apparently an irreducible minimum. The fall in death rate has been due to the virtual elimination of deaths from heart failure. Some deaths among cardiacs from other causes, particularly pulmonary embolism and bacterial endocarditis, are unavoidable. This unavoidable death rate is low, but many times higher than the rate for women with sound hearts.

3. The treatment of Class 1 cardiacs in pregnancy and the recognition and signs of heart failure in pregnancy have been discussed at some length.

4. A few observations have been made on whether or not abdominal hysterotomy is indicated for cardiac reasons alone.

PREGNANCY AND TUBERCULOSIS*

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TUBERCULOSIS appears not to be diminishing as rapidly among girls and young women as it is in other age and sex groups, therefore the combination of tuberculosis and pregnancy continues to be an important problem in preventive medicine.

It has been stated that during the past thirty years the sale of Christmas seals has made it possible for the tuberculosis agencies throughout the United States, under the leadership of the National Tuberculosis Association, to save the lives of 2,500,000 people. An unbelievable task, but, what about the tuberculous women in this very large group who have become pregnant? What has been done to save them from the deleterious effects of pregnancy superimposed on their tuberculosis?

Tuberculosis still takes some 75,000 lives in the United States each year. It is the leading cause of death between the ages of fifteen and forty-five years and of the 40,000 odd deaths between these ages, approximately 20,000 are amongst women. Just what proportion of these have become pregnant and have aborted or given birth at or near term we do not know. We do know however, that as a general rule, the gravida who has tuberculosis does not receive adequate care during pregnancy, labor and the puerperium. Furthermore she does not receive adequate medical supervision for a sufficient length of time following the lying-in period. In substantiation of these statements, Alice M. Hill has called attention to the appalling fact that only 87 or 21 per cent of 413 sanatoria in the United States, (there are a total of 463 tuberculosis sanatoria in the United States), admit or retain pregnant tuberculous women and keep them through delivery.

Of these institutions 43 are general hospitals, thus leaving only 44 tuberculosis sanatoria or 10.6 per cent of the total (413) that admit or retain pregnant women and take care of them through delivery; 247 or 60 per cent of the 413 sanatoria admit pregnant women but transfer them to general or special hospitals or to their homes for the delivery. Furthermore we find that 24 per cent of the private sanatoria do not admit pregnant women at all, and only 17 per cent of them keep the patient through delivery. Of the state sanatoria only 10 per cent keep their pregnant patients through delivery, while 71 per cent admit them before time for the delivery. Of the County sanatoria 22 per cent keep them through delivery, and 65 per cent transfer them for delivery.

In this report by Dr. Hill, nothing was said about the adequacy of the care these patients receive. Nevertheless, from the standpoint of their tuberculosis, there can be little doubt as to the adequacy of the treatment; from the standpoint of the pregnancy, labor and puerperium there is grave doubt. This is a natural supposition for no one would expect an expert obstetrician interested in tuberculosis to be associated with a tuberculosis sanatorium, except perhaps those situated in or near the larger cities. Of the 87 sanatoria reporting facilities for the care of pregnant tuberculous women, only a very few, probably not over 10 to 12, actually carried out the proper management of pregnancy, labor and the puerperium while the vast

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majority did the best they could with the facilities they possessed, realizing full well their inadequacies. The greater city of New York is in no better position for there are only 1 or 2 institutions in the city where the tuberculous woman who is pregnant can be adequately cared for through delivery and beyond the lying-in period.

What then is to be done to insure adequate care, both medical and obstetrical, for the pregnant tuberculous woman? I offer the following:

1. The ideal set-up for a tuberculosis and pregnancy clinic would be a special institution devoted exclusively to the care and treatment of pregnant tuberculous women. Here would be working in close harmonious cooperation a specialist in tuberculosis; an expert obstetrician interested in tuberculosis; a pediatrician also interested in tuberculosis; a roentgenologist; and the whole group supported by good pathological and bacteriological laboratories. In such an institution the tuberculosis, the pregnancy, labor and puerperium and the baby immediately after birth, could be adequately handled, and the "follow-up" of mother and baby could be ascertained with accuracy. Furthermore research in pathology and bacteriology of tuberculosis, including congenital tuberculosis, could be pursued to the end that something definite and constructive might supplant the confusion and chaos now existing.

2. In lieu of this ideal set-up the following is proposed: viz.; that each hospital group interested be allocated a certain number of beds for pregnant women with tuberculosis and that these patients be under the direct supervision of a tuberculosis specialist in cooperation with an obstetric specialist who is interested in tuberculosis. After the seventh month of the pregnancy the obstetrician should assume first control of the patient with the tuberculosis specialist cooperating. The obstetrician is to continue in charge until after the postpartum period (two or three weeks or longer) following which the tuberculosis specialist again assumes charge and manages the case as he would any other case of tuberculosis.

3. The management of the baby should be put under the direct supervision of a pediatrician interested in tuberculosis as soon as the umbilical cord is ligated. Decision as to the extent of mother-baby association, if any, can thus be made before contact-infection of the baby takes place. This arrangement is of the utmost importance, particularly where the mother's sputum is positive for tubercle bacilli. The pediatrician, of course, should follow the child through the adolescent period and see to it that a good internist takes charge when he shall have finished his job.

By this arrangement, research could be carried on by the various individuals concerned in the management of these cases and, with the cooperating team work of the various laboratories, reliable end-results could be ascertained. Moreover, under such a plan, diagnosis, classification and management would become much more standardized and systemized than has hitherto been possible. Naturally no plan will be successful unless the cooperating physicians, tuberculosis specialist, obstetrician, pediatrician, roentgenologist, pathologist and bacteriologist, are vitally interested in this type of work. Cooperation means success; lack of it spells failure.

The effect of pregnancy upon pulmonary tuberculosis is variable. As a matter of fact this same state of affairs is true in the non-tuberculous woman. It is a well known fact that in apparently normal women there are those to whom pregnancy is a benefit and who improve and thrive during this state. On the other hand, there are those in whom, almost from the outset, pregnancy causes a pathological condition, often fraught with grave danger to the mother. If we take such examples and add to them tuberculosis, it is reasonable to expect parallel results. To quote Allen Krause, "May it not be that pregnancy exerts a harmful effect on tuberculosis in those women, who without tuberculosis

would naturally tolerate pregnancy poorly, and a harmless, or even a beneficial, effect on those tuberculous women who, without tuberculosis, would stand pregnancy well, or even have their bodily economy improved by pregnancy?"

There have been well authenticated reports that claim active tuberculosis is benefited by pregnancy. In certain individuals with a given type of lesion this might well be true. Contrariwise certain other types in other individuals are undoubtedly made worse by pregnancy or labor or the puerperium, one or any combination of these three stages of childbearing. We must never forget that pregnancy or parturition or the puerperium may independently of one another, as well as in combination, produce ill effects upon tuberculosis. The modus operandi of just how parturition and involution stimulates activity in pulmonary tuberculosis is not clear, however, the foreign proteins thrown into the blood stream during the process of involution may be the activating cause. At any rate it is during the puerperium that the "flare up" of the tuberculosis is most likely to occur. Statistics vary, but from 10 to 85 per cent of patients are adversely influenced by childbearing.

Matthews and Bryant found that in 317 "graduates" of Trudeau Sanatorium at Saranac Lake, New York, 33 per cent dated the onset or relapse of their tuberculosis during pregnancy or after delivery. Furthermore if these 317 patients are classified into minimal, moderately advanced and far advanced types we find that 25 per cent, 33 per cent and 50 per cent respectively were made worse by pregnancy, parturition or the puerperium. Fishberg, in a series of 286 tuberculous women, found that 37.4 per cent developed symptoms of tuberculosis following childbirth. Ornstein and Kovnat found that of 85 tuberculous women who had borne children 36 per cent died, 18 per cent were unimproved or progressed and 46 per cent were improved. C. C. Norris from the Phipps Institute reported 166 cases in which 38 per cent were made worse, 37 per cent showed no change and 18 per cent were improved following childbirth. E. Rist of Paris, reporting on 52 cases of tuberculosis and pregnancy found that 84.6 per cent were made worse and 15.3 per cent were unchanged; 36.5 per cent died after one year and 50 per cent after the second year. Thus the list of statistics "goes on and on" without consistant end-results. Much confusion and many discrepancies continue to permeate most of the published reports because of the lack of accurate diagnosis, uniform standardization of classification and treatment of the tuberculosis. Futhermore from the obstetrical standpoint inadequate supervision is the rule, largely because the obstetrician does not understand the management of tuberculosis and does not cooperate with the tuberculosis specialist.

"When all is said and done," there has been sufficient evidence adduced to warrant the statement that pregnancy does exert a deleterious effect upon tuberculosis in a certain proportion of all cases but it also exerts a beneficial effect on certain other cases, while in still others there is no demonstrable effects. The satisfactory answer has not yet been advanced.

The effect of tuberculosis on the course of pregnancy is practically nil. Tuberculosis has no effect per se on fecundity, in many instances it increases fertility; the development of the fetus is normal; abortion or premature labor is no more frequent than in the non-tuberculous, except in those cases with severe exhausting cough, hemotysis, fever and marked general debility.

In the mild cases going to term the labor may be completed without cause for alarm. In the advanced cases labor may be tedious, prolonged and fraught with many dangers to the mother, e.g., dyspnea, cough, hemoptysis, impending cardiac failure, pulmonary edema, pneumothorax, etc.

Upon the puerperium mild inactive tuberculosis seems to have no effect per se, hemorrhage is no greater and involu-

tion is not retarded. In the more active and progressive cases there is apt to be excessive hemorrhage and involution may be tardy. These ill-effects naturally are due to the general asthenic condition of the woman at this time.

Of all the questions regarding the effects of pregnancy upon tuberculosis, nursing is one phase that should demand most careful consideration. The baby should never be allowed to nurse, except perhaps in those cases where the mother has a minimal healed lesion and it is highly desirable to give the baby a good start in life. In such cases the baby may be nursed for six to eight weeks. All others should absolutely *not be nursed.* The objections to nursing are, of course, the danger of infecting the child and the added drain upon the mother's strength. A "breakdown" in the mother may be due to child rearing just as with childbearing. Nowadays pediatricians are not so fearful of unsuccessfully feeding the newborn infant and hence this problem is much less troublesome than it was in former years.

While congenital tuberculosis is possible, as shown by Whitman and Green who have collected from the literature 47 authentic cases, it is relatively rare. I have never seen a case but believe if systematic study was made on every baby and placenta born of a tuberculous mother, particularly the more advanced cases, there would be many more cases of congenital tuberculosis than has hitherto been discovered. Futhermore "Sitzenfrey has demonstrated in women dying of tuberculosis the presence of bacilli in the interior of ova while still within the graffian follicles" (Williams). This could lead, although impossible to prove, to congenital tuberculosis.

Pregnancy complicating laryngeal tuberculosis is very bad. The mortality is said to be from 85 to 100 per cent. I have seen 2 such patients both of whom died within a few weeks of childbirth. Both babies survived and are in good health; there had never been any contact between mother and child.

The active treatment of pregnancy complicated by pulmonary tuberculosis naturally divides itself into (1) the general and (2) the obstetrical.

The general treatment is identical with that for any non-pregnant patient.

The obstetrical management includes (1) the question of the interruption of the pregnancy; (2) the method by which interruption is best accomplished; and (3) the best method of delivery at or near full term.

As to the question of the interruption of the pregnancy there are two very valid indications: (1), the vital indication, where it is necessary to save the life of the gravida who is in immediate danger of dying; and (2), the prophylactic indication, where abortion is done to prevent the progressive development of the disease which may be expected to occur from gestation and labor. Practically all therapeutic abortions will be done for the prophylactic indication.

During the first twelve to sixteen weeks of pregnancy therapeutic abortion is indicated in all proved active cases of pulmonary tuberculosis. This holds true for any stage of pulmonary tuberculosis, early or late. Activity and type of infection are more significant than the degree of involvment. The earlier the intervention the better the prognosis in all cases. Early interruption of the pregnancy with adequate sanatorium treatment usually means recovery and "arrest" of the tuberculosis. An "arrested" moderately advanced lesion, after two, three or four years of quiescence, is almost sure to remain inactive if pregnancy ensues. It is reasonably safe therefore to allow such a patient to proceed with pregnancy, provided strict prenatal supervision is carried out. If activity should become apparent during the first sixteen weeks of pregnancy, abortion must be performed immediately; whereas if the gestation is further advanced, from the twentieth to the twenty-eighth week, interruption of the pregnancy is contraindicated, except in rare instances where the mother is des-

perately sick and something must be done to save her life. Even here the shock incident to the evacuation of the uterine contents is distinctly bad. An inactive or healed early or moderately advanced pulmonary lesion is no indication for interference, provided the patient is in good or fairly good general health.

Advanced active or inactive cases should be aborted early and sterilized. Abdominal hysterotomy with removal of the uterine contents and ligation of the Fallopian tubes, using local, spinal or sacral anesthesia, is the method of choice. Hysterectomy or fundectomy, preserving menstrual function, may be done in selected cases. In the desperate cases we do a simple dilatation and currettage, or an anterior vaginal hysterotomy with removal of the pregnancy followed at a later date; when the general condition has improved, by radium or *x*-ray therapy in sufficient amounts to produce sterilization. The age of the patient, the activity of the infection, the type and extent of the lesion, and the patient's own choice in the matter, should be taken into consideration when deciding which method of sterilization is preferable in a given case.

From the sixteenth to the twenty-eighth week, artificial interruption should very rarely be undertaken, except in the active cases where the patient is growing worse very rapidly. If intervention is decided upon, sufficient radium introduced under local or sacral anesthesia, or *x*-ray irradiation to cause abortion or vaginal hysterotomy, with later sterilization by radium or *x*-ray irradiation are the procedures of choice. In young women where it is not deemed advisable to castrate, the oviducts can be ligated per vagina at the time of the hysterotomy or if, as some operators prefer, abdominal hysterotomy is performed, the tubes can be ligated very easily.

Should every case aborted be sterilized? No, certainly not; for with proper medical care, it might well be possible for the patient to become "arrested" and again become pregnant, say in two or three or four or more years, and carry to term with safety.

From the twenty-eighth to the fortieth week nothing can be done that will improve the condition. "Watchful waiting" may seem cowardly, but operative interference is almost sure to terminate fatally. However, here as elsewhere in medicine and surgery, individualization counts for a great deal. Under certain extenuating circumstances almost any established form of treatment may be altered, and oftentimes with fairly good success.

The method of interrupting the pregnancy and conducting the labor at or near term constitutes a very important phase of the treatment of pregnancy complicated by pulmonary tuberculosis. First of all, the best method of interruption of the pregnancy, whether early or late, is that method which will cause the least trauma and shock to the mother. Interruption during the first eight or ten weeks can oftentimes be done by the use of the cervical and vaginal pack, followed by currettage under local or gas-oxygen anesthesia, or in suitable cases, without anesthesia.

If the cervix is long, hard, and tightly closed, anterior hysterotomy under local, spinal, or sacral anesthesia is the operation of choice. From the twelfth to the sixteenth weeks anterior hysterotomy, under local, spinal or sacral anesthesia, is the best operation.

In certain multiparous patients, where the cervix is very soft and dilatable, cervical and vaginal pack followed by light currettage may be the procedure of choice.

Generally speaking, anterior hysterotomy (vaginal cesarean section) from the twelfth to the twenty-eighth week is the operation of choice. Beyond the twenty-eighth week vaginal cesarean section should not, except under very unusual circumstances, be done. Local, spinal, or sacral anesthesia is certainly to be preferred to any inhalation anesthetic. If for any reason an inhalation anesthetic must be given, gas-oxygen or cyclopropane is the safest.

If the pregnancy has been carried to or near full term the labor should be made as easy and short as possible. When labor pains are at regular and frequent intervals and the cervix is dilated to the size of "a twenty-five cent piece," (2 to 3 cm.) morphine scopolamine analgesia, or some one of the many other effective and well known methods of securing obstetric analgesia, should be employed to a degree sufficient for the relief of the stress and strain of the labor. As soon as the cervix is fully dilated rupture of the membranes, if these have not previously ruptured, episiotomy with the application of forceps and immediate delivery, using gas-oxygen or cyclopropane or local anesthesia during the active delivery, is the procedure of choice.

If the breech is presenting, follow the same routine, except deliver the breech as soon as possible. Full cervical dilatation should be had before any method of delivery is carried out. In the presence of a normal pelvis and baby, with fully dilated cervix and ruptured membranes, pituitrin, ¼ to ½ c.c., may be given. This with episiotomy and gas-oxygen anesthesia, will accomplish delivery in the shortest possible time and with the least shock to the mother.

If there is disproportion between the child and the pelvis or other cause for apprehension on the part of the obstetrician as to the outcome of the labor, cesarean section, under local or gas-oxygen or cyclopropane anesthesia, should be done. We use local in the form of abdominal "block" and find it highly satisfactory. Vaginal cesarean section should not be done after the seventh month of gestation, as even in expert hands the trauma and blood loss associated with this operation is considerable. This makes for more and often very severe shock which in turn is distinctly injurious to the tuberculous patient.

SUMMARY

Motherhood is the cherished hope of every woman. She should therefore not be deprived of this hope unless there is no alternative. Sweeping statements cannot, with sincerity and honesty, be made regarding pregnancy in tuberculous women. We have no right to say "no woman with tuberculosis can safely bear children" nor can we please Mussolini and say "tuberculosis doesn't matter; let her go ahead and have children, the country needs them for soldiers."

There is, however, "a middle of the road" attitude that we can assume and with a reasonably thorough understanding of the two associated conditions—i.e., the tuberculosis and the pregnancy—we may look forward to a successful outcome in a goodly proportion of cases. Success will largely depend upon the type and extent of the lesion and the degree of cooperation between the tuberculosis specialist, the expert obstetrician, the good pediatrician, the competent roentgenologist, and the loyal pathologist and bacteriologist.

If tuberculous women who wish to become pregnant or who are already pregnant have "taken the cure" and have learned how to live so as to conserve strength and health, and have the character and determination to carry out a rigid regime, there is no good reason for them not to procreate. On the other hand, pregnancy in the active tuberculous patient, no matter how little tuberculosis is present, is dangerous, in some cases very dangerous. Therapeutic abortion, therefore, should be performed. But if such patients will take the "cure" and will wait two to three or more years following "arrest," pregnancy may be undertaken with comparative safety.

In the moderately advanced active cases pregnancy is very dangerous. However, if three or four or more years is allowed to elapse following "arrest," during which time the general health has remained satisfactory, pregnancy may be undertaken with comparative safety even in these cases.

In advanced cases, especially with cavitation, it goes without argument, that pregnancy is absolutely contraindicated.

Nursing the baby should, as a rule, never be allowed. On the other hand, there are special instances where nursing may be allowed in order to give the baby a better start in life. The mother's reaction to labor and the early puerperium, of course, will largely determine the length of time the baby should nurse, but never longer than a few weeks. Since the modern pediatrician can feed the newborn infant so much more successfully now than formerly, nursing is not the serious problem from the baby's standpoint that it was in years past. It still remains, however, a most important problem from the standpoint of the mother's future health. "Do not nurse the baby" is a good working maxim.

The question of sterilization is most important. Every woman's mental attitude is plagued by the absence of the menses. It seems strange but when women menstruate, no matter what else may torment them, they seem more contented with their lot in life; therefore we are against permanent sterilization by means of *x*-ray or radium irradiation, except in those whom menstruation is "slowing up" the recovery of their tuberculosis to an unreasonable degree. In a certain number of young women where the "slowing up" process has been pronounced, I have advised temporary sterilization by radium or *x*-ray irradiation and have no cause to regret such advice. One such case became pregnant a few years later, carried to term, was delivered of a normal baby, and was apparently "no worse for the wear." Where simple tubal ligation is performed to prevent conception there is not the same disturbing element, for naturally menstruation continues as before ligation. Contraceptives, of course, are used and with fair success. But fear of pregnancy on the one hand and the difficulty of getting multiple abortions performed on the other, make this form of prevention unpopular with the average tuberculous patient.

Volumes have been written on this subject, but little has been done for the unfortunate gravida who has pulmonary tuberculosis. Sanatoria, clinics, floating hospitals and "rest homes" have been provided for "all ages and conditions" of patients, but no special provision has been made for pregnant women. Intelligent guidance through pregnancy, scientific supervision of the labor and puerperium, with proper care of the child and sanatorium treatment for the mother, should be the management for all such cases. However, under existing conditions, this can only be done for the "favored few." Surely it is not humane for us to continue to treat tuberculous pregnant women in the haphazard inadequate manner that we have so frequently done in the past. What we need is (1) a better understanding by the entire profession of the subject of pregnancy in tuberculous women; and (2) a larger number of properly equipped sanatoria and hospitals to adequately care for such cases.

Finally, the whole problem is very complicated; statistics are incomplete and often unreliable; experiences differ, largely due to the lack of standardized classification and procedure; there are diverse opinions. To pursue the proper course, doing justice to the mother, to the child, and to all concerned, demands our most careful thought and the exercise of the keenest judgement.

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TOXEMIAS OF PREGNANCY*

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A SUMMARY of facts and theories concerning the conditions at times grouped under this title, particularly considered from a clinical and practical viewpoint, is here designed.

The term "Toxemia of Pregnancy" and its various derivatives—for example "Nephritic Toxemia"—should be abandoned. In its place should be used, on the one hand, "Preeclampsia" and "Eclampsia," sufficiently discreet entities when seen in pure form; and on the other hand, such individual conditions as in the light of existing knowledge or opinion at any given moment it seems reasonable to consider in relationship to preeclampsia and to eclampsia, as for example "Essential Hypertension." The complete omission from consideration of certain ailments of pregnancy often ascribed to "toxemia of unknown origin" may serve to emphasize my belief that the term "toxemia" obscures and does not illuminate.

CLASSIFICATION

The necessity for a universally accepted classification is evident. Without this we have the present tower of Babel state of the whole affair. Only by using a universal classification can we within a reasonable time accumulate sufficient group data to raise treatment from the level of individual opinion to that of a reasoned rationale. So essential is the immediate need to establish and use such a classification that those to whom this phase of the subject has been of particular interest can afford to make concessions to one another's views. The more so in that any such classification must be tentative and that its perfection depends entirely on how it works out in practice in many clinics. This statement was proved to us when in the course of a few months experience with a "paper predesigned index," it became absolutely necessary to alter it to fit the cases as they appeared. I shall limit my discussion to two classifications and try to show that except for terminology and the inclusion or exclusion of certain debatable entities they are much alike and far from irreconcilable. Within the confines of these two classifications this ground may be covered completely. The best and most recent presentation and exposition of the Williams-Stander classification is to be found in Williams' Text Book,[1] 7th Edition, Edited by Stander, Chapter XXIX entitled "The Toxemias of Pregnancy." The headings in the order in which they appear are: (1) Vomiting of Pregnancy; (2) Acute Yellow Atropy of the Liver; (3) Low Reserve Kidney; (4) Chronic Nephritis Complicating Pregnancy; (5) Preeclampsia; (6) Eclampsia; and (7) Unclassified Toxemias. The previous chapter of this book is devoted to pyelitis and pyelonephritis and is not linked in any way to this classification.

Diagram 1 presents the most recent development of the Boston Lying-In Hospital Classification[2] with figures resulting from the first eighteen months study. The original scheme from which this developed is to be found in Irving's "A Text Book of Obstetrics."[3] This classification has for its primary concept the division of all cases into two great groups; (*A*), those presenting certain or presumptive evidence of disease independent of pregnancy and (*B*), those presenting no such evidence. Group *A* is classified on the basis of the Volhard and Fahr classification of the nephropathies modified to suit our idea of the needs in

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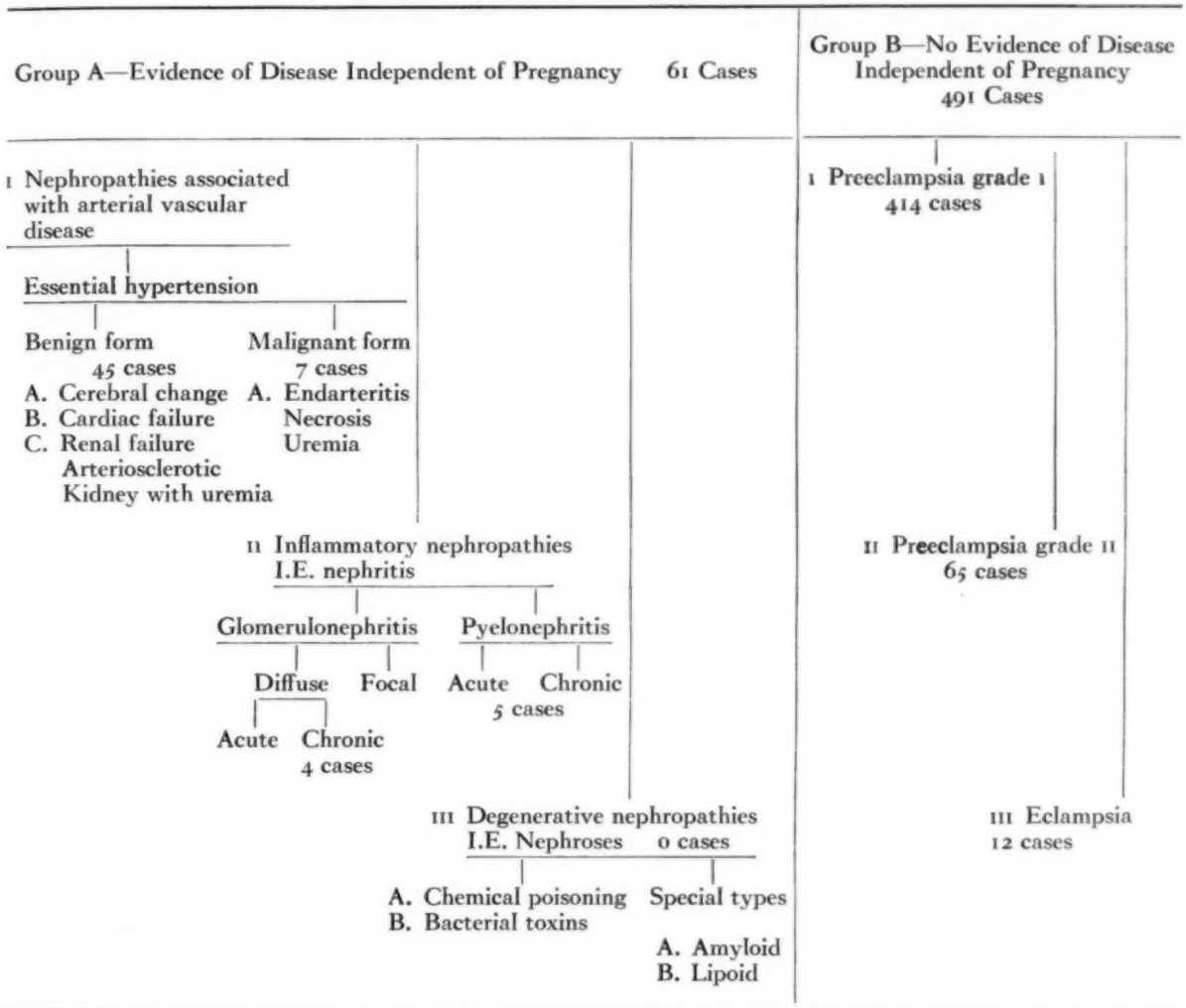
pregnancy. Group *B* consists of the commonly accepted ones of preeclampsia and eclampsia (well called the "Eclamptic State" to emphasize identity) with a debatable group called preeclampsia grade 1. In the paper in which we first presented this classification we have discussed the limitations of this group.[2]

The discrepancies in these two classifications, if one reads carefully the text which accompanies them, may be divided into those that are unimportant and those that are possibly somewhat more important. Whether one prefers to include certain debatable entities, as for example "Vomiting of Pregnancy," or to regard them under separate headings, is unimportant. Whether one wishes to term the pigeon hole into which we file for future reference mild cases not yet studied far enough to identify "Low Reserve Kidney" or "Preeclampsia Grade 1" is unimportant. The term "Low Reserve Kidney" is an academic one, and patients can only be so diagnosed surely months after delivery. The term "Preeclampsia Grade 1" is a refusal to admit, particularly for teaching purposes, that any pregnant woman with hypertension and/or albuminuria can be trusted not to go on to eclampsia. In practice each school is equally vigilant of such a patient. "Essential Hypertension"

DIAGRAM I

TOXEMIA CLINIC, BOSTON LYING-IN HOSPITAL, JANUARY 1, 1935–JULY 1, 1936, 552 CASES

Hypertension and/or Albuminuria of Pregnancy



and "The Arteriosclerotic Type of Chronic Nephritis" mean the same thing. The difference is one of terminology. We prefer the former because the condition is presented to us so frequently first in pregnancy solely as a hypertension and because the term points to the diffuseness of the condition and away from kidney localization. Possibly this may be considered as one of the more important differences. So we may conclude they are not basically so very different and that from them a generally acceptable tentative classification might be fashioned.

The Nephropathies (Group A). For a discussion of diagnostic criteria and difficulties in this group (Diagram 1) the reader is referred to our paper on classification.[2] In summary to illustrate what we need to know I may make the following statements: (1) That in essential hypertension with low hyperpiesis early in pregnancy, as for example 140/90 at the third month, we have as yet no criteria on which to base a sufficiently sound prognosis to decide whether or not we should attempt to take the patient through pregnancy. If we try one of three things may happen: she may succeed—we do not know in advance at what cost; or she may fail, when in the effort to obtain a live baby we may find that we have done irreparable damage; or she may fail or succeed with no apparent change to her own health. It is desirable that we should be able to predict each outcome in advance. (2) That acute glomerulonephritis as a complication of pregnancy is extraordinarily rare in our experience but that more careful study along the lines suggested by Dieckmann[4] may show it to be less rare than we think. (3) While we have the impression that mild cases of chronic glomerular nephritis may pass successfully through pregnancy we have as yet little evidence to back up this statement. (4) That certain chronic glomerular nephritis is far less common with pregnancy than some other writers believe. (5) That pyelonephritis in pregnancy in relation to the eclamptic state is more important than is currently believed. (6) That nephrosis is a hazardous diagnosis to make in pregnancy[4] if we define this term as in our classification paper.[2]

It is apparent that the "nephropathies" (Group *A*) must be considered as complications of pregnancy to be treated in present knowledge according to the behavior of each individual case as it is observed—the uterus to be emptied by the best means depending on the obvious conditions in the patient and baby—in the event that she becomes worse in spite of medical treatment. It is I think, equally true that some of these conditions must be viewed as well as etiological factors of the eclamptic state.

Etiology of the Eclamptic State. It is impossible and undesirable here to attempt to cover all theories concerning the etiology of the eclamptic state. An examination of recent contributions to this question shows the net result to be an accumulation of a vast amount of interesting and suggestive data, with weak links in every chain. It cannot be said that Hofbauer's[5] development of the posterior pituitary theory of the cause of eclampsia is not correct, but it can be said that it is not yet proved. Failure to find pressor and antidiuretic substances in the blood of patients classed as "toxemic" by Hurwitz and Bullock[6] and Byron and Wilson[7] show the weakest point in this thesis. Further work may prove that this failure is due to technical fault. Even so the identity of the two substances, i.e. postpituitary and the *x* of the eclamptic blood, remains to be shown.

Various descriptions of placental pathology are advanced by different students in an effort to link these with the etiology of eclampsia. I compare, again for example and not to cover this field, two recent sets of observation in the years 1932 to 1936. Tenny[8] observed a thickening of the basement membranes of the villi in eclampsia and preeclampsia and later[9] an increase over the normal amount and severity of syncytial degeneration in the toxemias sufficiently marked to be of diagnostic value. Bartholomew and Kracke[10,11]

find changes in similar placentas in the form of infarcts akin to the cholesterol induced changes in the coronary arteries of rabbits, (as shown by Leary) and on this basis have built a complete hypercholesterol explanation of the eclamptic state. Since these observations are things that can be seen under the microscope with the trained pathological eye they have the merit—not universal in the realm of etiology of eclampsia—of being soon proved or disproved. Bartholomew and Kracke[11] furthermore state that "hypercholesteremia is probably responsible for nausea and vomiting of pregnancy through an increased secretion into the bile until storage of this material can take place in the reticulo-endothelial system." Whereas Hayes[12] says, "I have treated" (by relief of back pressure by kidney pelvis drainage) "prior to delivery 39 cases of pernicious vomiting, preeclamptic toxemia or eclampsia. All the mothers showed an immediate improvement after the kidneys were drained, and all ultimately recovered." Nineteen of the 39 cases were pernicious vomiting. There is a marked discrepancy between the ideas here expressed, for if the former are right the latter should perhaps have drained the gall bladder and not the kidney pelvis. Yet, Peters[13,14] and others have stressed the relationship of pyelonephritis to preeclampsia, and remarkable as the claims of Hayes appear, it must be admitted that in our hands at least the genitourinary aspect has been neglected. So has the matter of irridation of the pituitary and adrenals which is thought by some to offer possibilities in view of reported good results in essential hypertension.[15] The primary etiology must be left, by one who has no notion as to the cause of eclampsia, in a quite confused state; the endocrines and the placenta having first call at present, leading to "a disease vascular in nature best explained on the basis of arteriolar spasm."[16]

Certain factors acting as secondary or contributing causes must be considered. I have referred to two aspects in which it seems wise to view the nephropathies, one as direct complications of pregnancy to be treated as each case behaves, the other as contributing causes of the eclamptic state. Essential hypertension and suspected chronic glomerular nephritis have been shown by Corwin and Herrick[17] and Herrick and Tillman[18] to belong in the latter category. Peters[13,14] especially has emphasized the causal relationship of pyelonephritis and the eclamptic state. The exact and percentage relationship between these conditions and the eclamptic state has yet to be worked out in a great group of cases followed to autopsy; but a more or less general acceptance of this point of view is already apparent, and hence, patients showing these conditions require the most constant observation possible if the existing state of the disease warrants continuation of pregnancy.

Around focal infection has grown a voluminous literature in this relationship—both of itself directly, and indirectly, in relation to placental infarction and far fetched conclusions have been drawn from observations concerning this. For example, that, released by focal infection, tyramine is responsible. "If we are able to produce convulsive seizures in a dog by the use of tyramine, then we feel that the poisonous amines are responsible for the toxemias of pregnancy."[19] It may be said that each propounder of a complete solution of eclampsia reasons somewhat in this fashion. The acceptance of one individual's theory by the creator of a different one would be impressive but so far as I know this phenomenon is not yet recorded. However, the elimination of obvious focal infection is held by most obstetricians to be a wise prophylaxis against the eclamptic state, although Palmer[20] has pointed out that foci of infection are somewhat more common in patients (non-pregnant) without hypertension than in those with hypertension. He further concludes that the two chief etiological factors in hypertension are inherited predisposition and obesity. From

a practical point of view it is my opinion based on experience that obesity is the most important secondary etiological factor in the production of eclampsia. Fortunately, obesity and faulty elimination, another important factor, can be readily prevented. Exposure to cold and wet, infections, worry, loss of sleep and overwork and tiredness have repeatedly been the immediate precursors of "toxemia."

The Differential Diagnosis between the "Nephropathies" and Preeclampsia as an Immediate Clinical Problem. It is apparently believed by some that the differential diagnosis between the nephropathies and preeclampsia in pure form or mixed is always possible within the narrow time limit of one pregnancy. In our experience we have not found this to be true. The clinical importance of so distinguishing it is sometimes not of great account at any given moment, opportunity for more prolonged observation without detriment to the patient often answers the question. Sometimes again an immediate differential diagnosis is of great clinical importance. For example, a primipara with essential hypertension of 140/90 at the beginning of pregnancy, at the thirtieth week has developed headache, albumin, edema, subjective and objective eye symptoms, irritability and a blood pressure of 250/150. How much is essential hypertension, how much is preeclampsia? What may we expect her to do? Should we try to carry the patient for another week or ten days in an effort to get a better baby that will probably be her last? Will the baby die in utero if we do? Will she have convulsions; will she separate the placenta or have a "cerebral accident"; will she get cardiac decompensation? I do not know the answer to any of these questions. In this particular patient and with the advice of a pediatrician who said the baby was better off out of than in this woman, I did a hysterotomy, got a good looking and active baby weighing three pounds, five ounces. The pediatrician assured me the baby would do well, and it died within twenty-four hours of massive atelectasis. Six months later the patient's blood pressure was 180/120. Was my judgment good or bad? In any event, a quick test to prove the presence or absence of a preeclamptic element would have placed me in a stronger position to decide the moment for interference.

Another example; Mrs. C., a para IV, thirty-nine years old, entered the hospital July 8, 1935, because of marked edema, dyspnea and orthopnea. She had three other living children, all delivered at home; the second one was induced for "edema." She gave a history of hypertension and albuminuria before the fifth month in this pregnancy. Her local doctor said she had no hypertension or albumin or cardiac symptoms before she became pregnant this time. On entrance, she weighed 301 pounds; she was thirty-two weeks pregnant; her blood pressure was 200/120. The urine boiled solid; and the specific gravity was 1.037; urea clearance was 45 per cent once and 145 per cent a few days later.

She remained in the hospital twelve days under observation. During this time, everybody on regular and special service saw her, and the diagnosis vacillated between primary hypertension with cardiac asthma, and myocardial insufficiency (in an older day "cardiorenal" disease) on the one hand, and preeclampsia, grade II on the other, or a mixture of both. Finally because she seemed to be getting worse, irrespective of the diagnosis, I emptied her uterus with a bougie and pack. Four months later from another hospital came the diagnosis "subsiding glomerular nephritis." Her blood pressure was then 100/80. She had no cardiac enlargement. Thirteen months after delivery we observed her blood pressure at 122/82; the urine showed normal urea clearance and no albumin. Pathological examination of the placenta had shown "Multiple areas of infarction and necrosis. Old and recent hemorrhage, necrosis and atheromatous degeneration of arterial sinusoids."

So far as studied one year after delivery, this patient had preeclampsia grade II and not the other suspected condition at the time of her delivery. Had we had a sure method of diagnosing this patient, we would not have carried her so long as twelve days

while the preeclampsia got worse, to a point where her recovery seemed doubtful.

Examples of the desirability of knowing surely and at once the presence of a preeclamptic element might be multiplied. All liver function tests are of no help. Blood vessel changes in the eye grounds except in the pronounced cases, give contradictory and not conclusive evidence in different observers' experience. Renal function tests are not dependable. Urea clearance is indeed of value in following patients over a long period of time, but not in the last months of pregnancy. The dilution concentration tests give abnormal values in normal pregnancy thus at present vitiating results in this connection.[21,22] The "cold test"[23] gives different results in different observers' experience and does not disprove superimproved preeclampsia on hypertension any way. The posterior pituitary test of Dieckmann and Michel[24] is likely enough a real differentiation test, and is also interesting in the light of the posterior pituitary theory of etiology. However, the production of added oliguria and added hypertension to the preeclamptic state seems too risky to make it applicable. The possible production of acute pulmonary edema or separation of the placenta as reported by them is too hazardous. Blood chemistry, specifically increased uric acid in the blood and diminished CO_2 combining power fail frequently to identify the presence of preeclampsia. Recent work of Smith and Smith[25] is interesting from the point of view of differential diagnosis. These workers regard their observations also from etiological and therapeutic standpoints. Etiologically, it seems to me in their own words "a matter of conjecture," and therapeutically viewed, it seems worthy of a

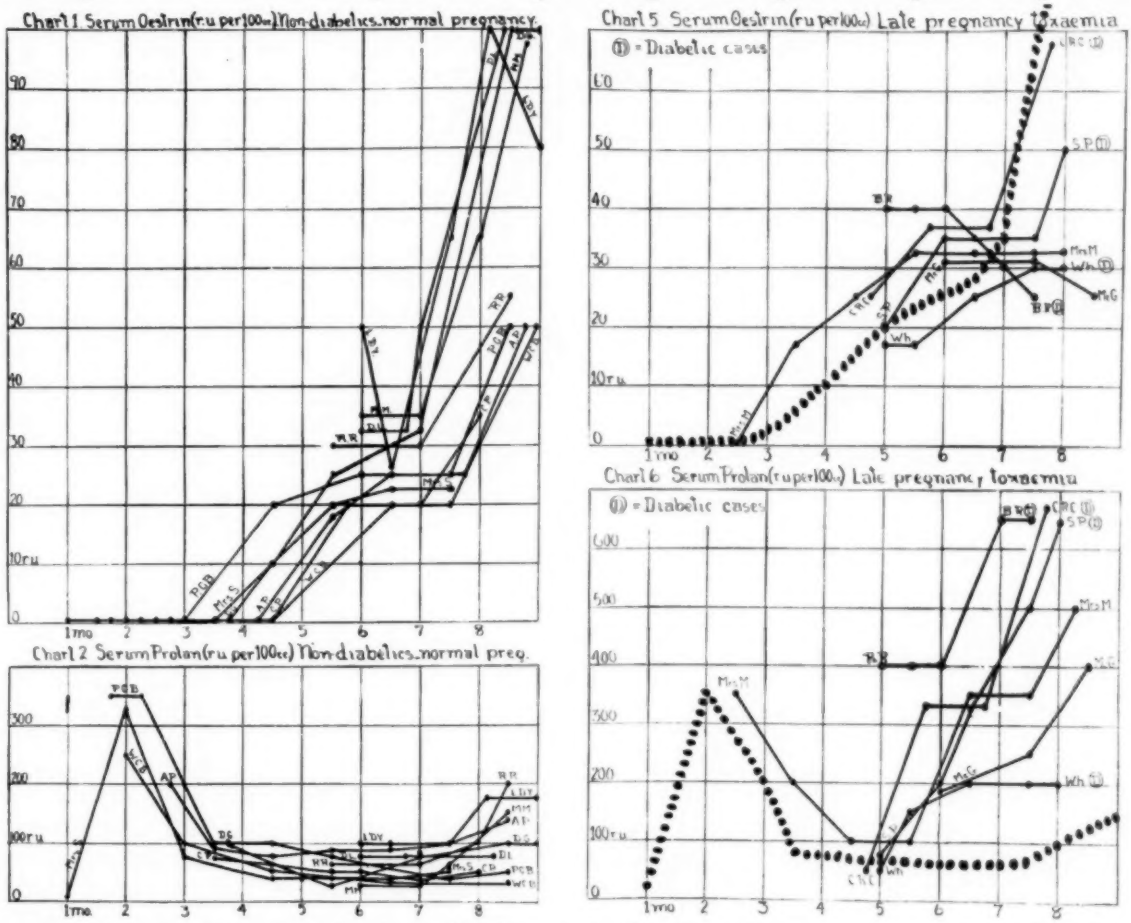


Chart 1 Serum Oestrin (r.u. per 100 c.c.) Non-diabetics. normal pregnancy.
Chart 2 Serum Prolan (r.u. per 100 c.c.) Non-diabetics. normal preg.
Chart 5 Serum Oestrin (r.u. per 100 c.c.) Late pregnancy toxaemia
Ⓓ = Diabetic cases
Chart 6 Serum Prolan (r.u. per 100 c.c.) Late pregnancy toxaemia
Ⓓ = Diabetic cases
1mo
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Chart 1. Prolan and estrin composite chart of Smith and Smith, original Charts 1 and 2 and dotted line, Charts 5 and 6.

trial. As a test of the presence or absence of preeclampsia or (occasionally in the differential diagnosis of eclampsia from other types of convulsions associated with pregnancy) it seems immediately of great value. Chart 1, kindly supplied by the authors, shows their findings in essence. The eclamptic state alone gives abnormally high prolan and abnormally low estrin curves as compared with those in the normal pregnant woman, the pregnant hypertensive and patients with chronic nephritis, and the pregnant diabetic. The high prolan has been observed to occur in at least 6 cases six weeks before a clinical diagnosis of preeclampsia could be made. This would seem to show the test to be one of great delicacy. A reasonable degree of accuracy in the test can be obtained in five days. From the point of view of etiology and therapeutics, they maintain that if the high prolan which is placental prolan, together with low estrin, is responsible for the eclamptic state, (the pathological process involved being to their minds akin to menstruation), then the raising of the estrin level by injections, may with its antagonistic action to the prolan lower it and correct the imbalance. Here again are a series of observations capable of check.

PATHOLOGY

This section covers certain aspects of the pathology which Hertig has presented to the staff of the Boston Lying-In Hospital during his term of office in the pathological department of that hospital.

Examples of fatal cases of preeclampsia are rare in the literature and are almost wholly confined to those cases of so-called "eclampsia without convulsions." The only fatal case of acute preeclamptic toxemia studied at postmortem in this clinic was that of a patient who died suddenly during an attack of cardiac asthma. While many of the pathological findings, such as edema of myocardial stroma, marked pulmonary congestion and edema, hydropericardium and bilateral hydrothorax, were linked with the sudden cardiac death, there were definite lesions in the liver, kidneys and brain which differed in no way except in degree from those of fatal eclampsia. The almost invariable subcapsular and periportal or portal petechial hemorrhages found in eclampsia were present in the liver of this patient. Early degenerative lesions, in much earlier state of development than those found in true eclampsia, were also present in the liver (Fig. 1). They consisted of fragmented liver columns, periportally arranged, the cells of which contained "bird's-eye bodies," lesions pathognomonic of cell damage, although the cells had not yet reached the stage of necrosis. The renal glomerular epithelium and endothelium were the seat of necrosis and fatty degeneration, while the capillary tufts occasionally contained fibrin thrombi. The basement membrane, however, had not yet reached the stage of irregular thickening shown by Bell to be characteristic of eclamptic kidneys. This suggests that the thickening is a secondary or at least a later appearing phenomenon. Polymorphonuclear leucocytes were present in moderate numbers within capillary loops of the glomeruli. The convoluted tubules showed evidence of fatty and hyaline degeneration while their lumina contained granular precipitate and damaged desquamated epithelial cells but no hemorrhage or hemoglobin casts.

Recently we have had the opportunity to study a fatal case of pulmonary embolism who had suffered from severe preeclamptic toxemia ten days prior to her death. The liver showed no lesion other than a prefatty infiltration, and the kidneys showed no lesion other than a pre-existing subacute pyelonephritis. All of the lesions described in the preceding fatal case of preeclampsia, complicated by cardiac asthma, with the exception of the glomerular fibrin thrombi, could have existed in the last mentioned case and yet have been repaired by the time the patient died ten days after delivery of a disease unassociated with her toxemia. The absence of glomerular fibrin thrombi in the last mentioned case is of no

significance since these lesions are by no means universal even in the kidneys of full blown eclampsia.

The following summary of the pathological anatomy of eclampsia was gained from experience with 11 fatal cases, 9 of true eclampsia and 2 cases of eclampsia without convulsions. No significant difference was noted in the pathology of the two clinical types of toxemia.

The hearts varied from 220 to 380 grams. Approximately one-half were negative grossly and microscopically, but focal necrosis of the myocardium (2 cases), petechial hemorrhages (4 cases), thrombosis of capillaries (2 cases), edema of the myocardium (2 cases), and fatty degeneration of the myocardium (one case) were encountered. The abnormal hearts showed varying combinations of these mentioned lesions.

The lungs, with the exception of one case, showed varying degrees of congestion and edema, often accompanied by terminal bronchitis and bronchopneumonia.

The spleens varied from 115 to 605 grams with the average above normal. In general the consistency was soft and the pulp congested and hemorrhagic. In approximately one-half the cases evidence of a so-called "toxic splenitis" was encountered: necrosis of stromal cells in the follicles, infiltration of these structures by a few macrophages, and the deposition of fibrinoid material in the meshes of the involved follicle. This picture is similar to that seen in diphtheria and in some cases of overwhelming streptococcal sepsis. Hyalinization of follicular arterioles, seen in one-half the cases, is probably not a significant lesion with regard to eclampsia.

The livers were usually of average normal size with occasional ones weighing 2300 grams. No adequate explanation was found for the largest since no appreciable fat was present, except in one instance when the liver was also greatly enlarged. Subcapsular petechial hemorrhages were usually present as small collections of extravasated red cells approximately 1 mm. in diameter, unassociated in the majority of cases, with the universally present focal necrosis. The latter lesion varied in type,

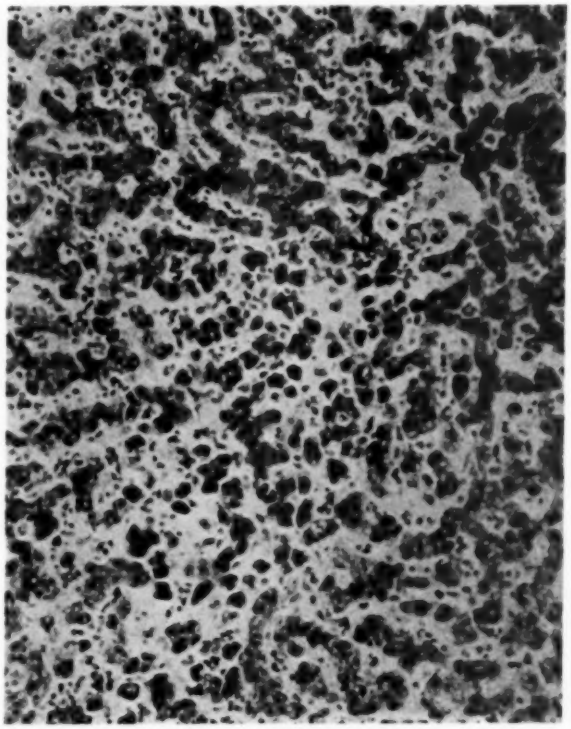

Fig. 1. Liver from case of fatal preeclampsia complicated by cardiac asthma and pulmonary edema. Note fragmented, but non-necrotic liver cell columns in periportal distribution extending out into lobule. × 170.

magnitude and distribution. Similar variations have been pointed out by Acosta-Sisson in a much larger series of cases. The hepatic arterioles were thrombosed in 2 of the cases suggesting very strongly a vascular pathogenesis of the "eclamptic liver lesion" in general and for these 2 cases in particular (Figs. 2 and 3). The foci of necrosis were periportal, mid-zonal or central with occasional combinations of various distributions. Necrosis alone existed as well as necrosis associated with fibrin masses distending sinusoids.

The kidneys almost always showed enlargements, a soft consistency and varying degrees of cloudy swelling. The glomeruli were usually swollen, ischemic, and showed irregular thickenings in their capillary walls due to thickening of the basement membranes, a finding first recorded by Bell in

1932. Less constantly was the swollen endothelium of the glomeruli infiltrated with small numbers of polymorphonuclear leucocytes in the capillary loops. In only one instance were there capillary thrombi. The convoluted tubules inconstantly were the seat of fatty and hyaline degeneration and rarely focal necrosis. Only rarely were the collecting tubules involved. Three cases of eclampsia were complicated by pre-existing renal disease; namely, one of hydronephrosis and 2 of progressive vascular nephritis (arteriolosclerosis).

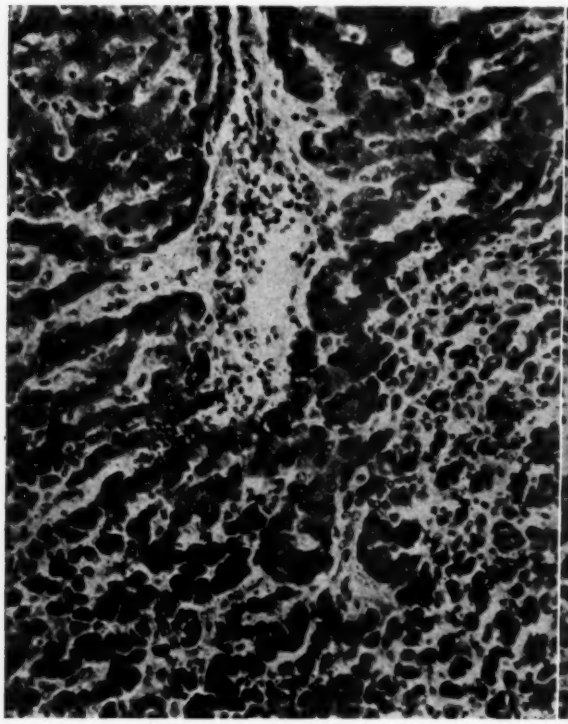

Fig. 2. Liver from a case of fatal eclampsia without convulsions. Note thrombosed hepatic arteriole and recent focal necrosis of mid-zonal distribution. × 170.

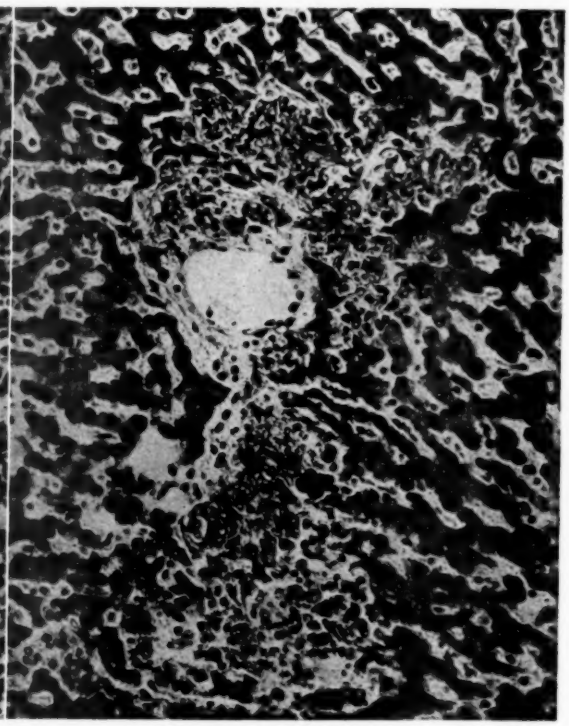

Fig. 3. Liver from case of fatal eclampsia with convulsions. Note periportal necrosis associated with fibrin thrombi in associated sinusoids. There is necrosis of mid-zonal region beyond. × 170.

The adrenals showed petechial hemorrhages in approximately one-half the cases, associated in one instance with necrosis and fibrin thrombi in the cortex.

The uterus in over half the cases showed cornual and subserosal hemorrhages, usually bilateral. This is of interest when it is recalled that a similar though more marked lesion occurs in fulminating toxic separation of the placenta. Then too, patients with preeclampsia and eclampsia have premature separation of their normally implanted placentas more frequently than do normal pregnant patients. The generic relationship between these forms of toxemia and toxic separation of the placenta is further shown by the fact that both these forms of toxemia may rarely continue to bilateral symmetrical cortical necrosis of the kidneys.

The brain in these cases of fatal eclampsia was usually the seat of a variable degree of congestion and edema, a finding noted by all observers. However, 3 of these cases showed no appreciable change of this nature. Intracranial hemorrhage was a cause of death in 2 of this series of 11 cases and was present to a lesser degree in a third. These fatal cerebral hemorrhages were in cases of pre-existing cerebral arteriolar sclerosis. Focal lesions which have been described as occurring in the brains of eclamptic patients (Diamond, 1936) were not noted. It must be stated, however,

that a detailed neuropathological study of these brains was not performed. Since these focal lesions are reported as rare and of glial proliferative nature, it is quite possible they were overlooked. Likewise, search for ganglion cell changes were made but were not found although such lesions are reported together with aseptic meningitis and microglial changes.

BEHAVIOR OF THE NEPHROPATHIES AND TREATMENT

1. *Essential hypertension* (Group *A* 1) benign and malignant. Great difference in behavior of patients with essential hypertension may be observed both in different patients apparently with the same degree of disease and in the same patient in different pregnancies. We have certain impressions with regard to differences of behavior depending on age of patient, and occurrence in clinic as opposed to private practice, but nothing really to substantiate these impressions. I believe we must have greater experience with the long time study of such patients, especially the "malignant" group, since some of those considered "malignant" on earlier study seem so far not to have proved so. Treatment at present must follow rule of thumb indications as they appear.

2. *Nephritis* (Group *A* 11). Our lack of experience with acute glomerular nephritis (or with its recognition) permits us to accept at present Dieckmann's[4] conclusions regarding it, and to attempt more frequent diagnosis on the basis of his findings. True chronic glomerular nephritis with pregnancy has impressed us by its relative rarity or the rarity with which we have been able to diagnose it. Since the chronic form may present varying amounts of renal damage with exacerbations of renal insufficiency, it gives rise to many diagnostic difficulties. This is particularly true if first observed after the twentieth week of pregnancy. Many patients with this disease have complete compensation of renal function. However, with the added load of pregnancy, certain degrees of kidney failure may be produced. The more severe forms are usually recognized early in pregnancy, and appropriately treated. Patients with minimal or subclinical chronic glomerular nephritis may not show evidences of renal insufficiency until after the twentieth week of pregnancy. In these patients the differential diagnosis between chronic glomerulonephritis and preeclampsia appears to us on occasion to be impossible as the problem now stands (vide supra). Only in the follow-up of these patients can the ultimate diagnosis be made.

It is our impression that the milder cases of chronic glomerulonephritis often progress to a successful termination of pregnancy. However, we would also emphasize that there is an occasional patient in this group who may for the first time, late in pregnancy, show severe renal insufficiency with uremia, manifested by convulsions and/or coma. That such a patient has occasionally been mistakenly diagnosed as an eclamptic there can be no doubt. We have seen one such case at autopsy.

The management of chronic glomerular nephritis complicating pregnancy depends on meeting indications as they arise; the degree of renal impairment checked at times against the duration of the pregnancy and estimated size of the baby in an effort to obtain a living child. It is my impression that as a general principle it is wiser to take the smallest possible child that seems to have a chance to survive than to try to let it grow larger in utero because of the tendency to intrauterine death. This is the reverse of my point of view concerning the baby per se in essential hypertension. I have no evidence to support this contention, and this feeling is not shared by some of my associates. Practically, it works itself out in my mind, irrespective of the finer points of diagnosis, that it is safer from the point of view of intrauterine death to carry a patient with relatively high hypertension and low albumin than with relatively large amounts of albumin and low hypertension.

Focal glomerular nephritis is only a complication of the pregnant state in pregnant women with septic endocarditis. We have seen one such case at autopsy.

PYELONEPHRITIS

Reference to Peters'[13,14,26] work has already been made. For many years I had observed at infrequent intervals a group of "pyelitistoxemia" cases of bad prognostic import without the slightest notion of cause and effect relationship, considering them simply as coincidental mixed types. The importance of his work in this field cannot be overestimated. It is comparable to that of those other internists, Corwin and Herrick and Tillman,[17,18] for clarifying the relationship of the other nephropathies to the eclamptic state. Elsewhere we have said of this group,

> Under the inflammatory nephritides we would add pyelonephritis which may occur in the acute and chronic form. From many sources attention is being called to this type of kidney pathology in the production in later life of hypertension which is many times associated with kidney failure. As a complication of pregnancy, doubtless, too little attention has been paid to it in the past, and we would emphasize the need for more careful study of this group of cases with a view to a clearer understanding of the relationship between urinary tract infection and the "kidney of pregnancy." So-called pyelitis is a frequent complication of pregnancy, antepartum and postpartum. It seems certain that a number of these patients develop, or have developed, prior to the appearance of the "pyelitis" an infection of the true kidney parenchyma, which in certain instances has resulted in permanent renal damage. In the acute stage of pyelonephritis, the clinical course may simulate severe pyelitis with or without renal failure which is usually transient. The amount of permanent kidney damage is quite variable as it enters the chronic stage. Here the differential diagnosis from chronic glomerulonephritis is difficult. The presence of infectious elements in the urinary sediment in chronic pyelonephritis in contrast at the same time to the meagre or absent hematuria and casts is most important. Pyelography may be of some assistance. The routine kidney function tests and blood chemistry are of value to determine the amount of kidney impairment.

The treatment of pyelonephritis in pregnancy should be to empty the uterus on failure of the patient to improve from an attack of "pyelitis of pregnancy" within a reasonable time after the establishment of treatment by medical and genitourinary methods. That the condition may be extraordinarily dangerous in the present and in the future seems probable.

Degenerative Nephropathies, i.e. Nephrosis. We believe that the diagnosis of nephrosis during pregnancy is an extremely hazardous one. Certain findings in this disease may be found in the normal pregnant patient, namely, high cholesterol values with lowering of the serum proteins of the blood, and the occurrence of double refractory lipoid bodies in the urine.

Our experience with chronic nephrosis in pregnancy has been practically nil. Such cases in the past as we have so diagnosed were probably, according to our definition (1) chronic glomerular nephritis without renal failure or (2) chronic glomerular nephritis in the "nephritic syndrome" stage if they were observed before the twentieth week of pregnancy; or if they were observed after this (3) preeclampsia grade I. The question of chronic nephrosis and of acute nephrosis (lipoid) is discussed by Dieckmann in an article previously mentioned.[4]

GROUP B

1. *Preeclampsia Grade I.* We have defined this heading for classification purposes to cover cases in which there is no evidence of disease apart from pregnancy, which show hypertension and/or albuminuria without other signs or symptoms.

2. *Preeclampsia Grade II.* The same together with some or all the signs and symptoms commonly attributed to the preeclamptic state.

3. *Eclampsia.* The same as preeclampsia grade II but with convulsions in addition, or occasionally without convulsions

when such a patient dies in coma, (or after a "shock") and shows at autopsy findings identical with eclampsia.

very rarely, fulminating—without warning. Since this is true, a weekly urine examination and a blood pressure and

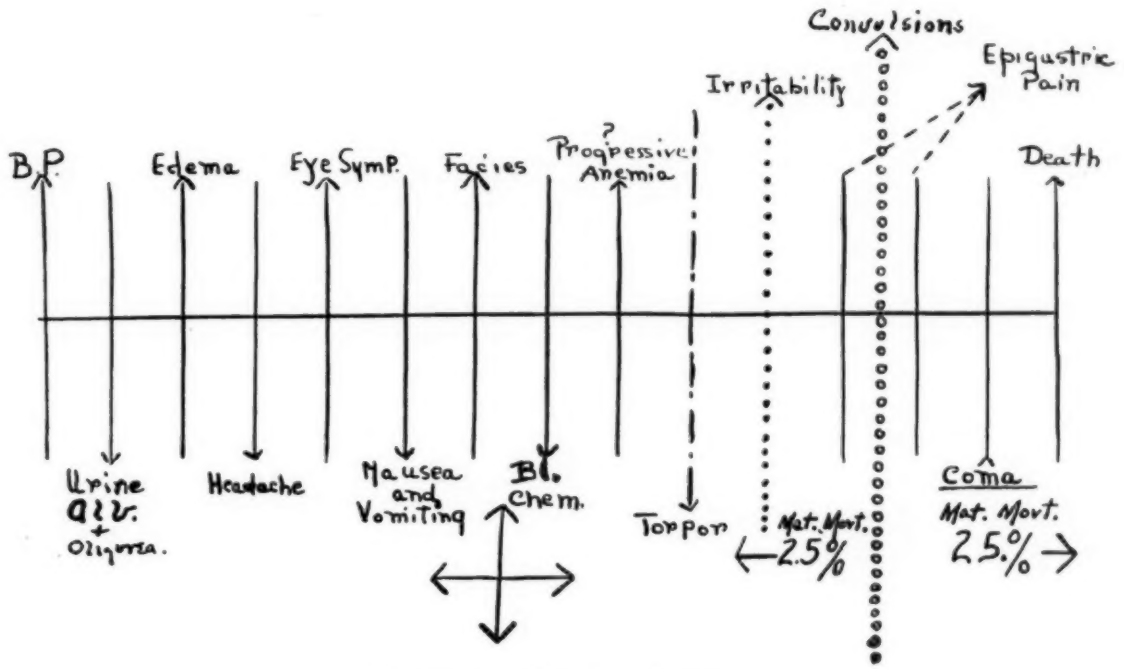

Diagram II. The eclamptic state.

I have made prior reference to the Group Preeclampsia Grade I and shall omit it in further discussion in this paper. The cases either prove to be something else, remain as such, or go on to Preeclampsia Grade II.

Preeclampsia Grade II and Eclampsia we believe to be the same disease except in degree (vide supra "Pathology").

Signs and Symptoms. The well known signs and symptoms of relative hypertension, albuminuria, edema, especially of the face, sudden weight gain, blurring of vision, nausea and vomiting, constitute premonitory signals and sufficient cause whenever possible to hospitalize the patient. Increased respiratory depth, torpor and irritability, mental or motor, constitute the final danger signals. Epigastric pain, convulsions, coma, and death within thirty-six to forty-eight hours too frequently constitute the termination of the eclamptic state. It is important to note that this condition progresses at different rates of speed, i.e., slowly in a matter of days or even weeks, rapidly in a matter of hours, or

weight record every two weeks is the minimum requirement for proper prenatal care. Even then, some "quick cases" will get off to a long start before detection. We have come to feel that borderline diastolic pressure, 90 to 100, is an important prognostic sign. If a patient shows any of these signs or symptoms and cannot be hospitalized for observation because of economic reasons, a daily urine specimen and blood pressure reading every other day constitute the minimum requirement.

It is wise to consider the eclamptic state in toto because on its usual behavior depends the rationale of the treatment of preeclampsia. Eclampsia is caused by pregnancy. It is a disease self-limited by the termination of its cause either by fetal death or delivery or both. Frequently the mother dies before these eventualities occur. Sometimes she dies afterwards from a prolongation of the effect of the cause. Eclampsia is usually a rather slow to appear (sometimes more abrupt) culmination of a progressive state characterized by a

usually definite train of signs and symptoms known as preeclampsia. The course of most cases may be simply illustrated for the sake of our argument as is shown diagrammatically in Diagram 11. Davis and Harrar[27] state, "We find statistically that the sooner the woman comes to delivery after her first convulsion, the better are her chances of recovery." Most authors find postpartum eclampsia gives the lowest mortality. In the Boston Lying-In Hospital[28] series antepartum eclampsia had a mortality of 33.6 per cent, in intra and postpartum eclampsia combined it was about 17 per cent. In our experience then antepartum eclampsia is about twice as dangerous as the other types.

Maternal mortality in eclampsia at the Boston Lying-In Hospital since 1915 has never been less than 20 per cent under four different methods of treatment, three of them definitely conservative, in approximately 173 cases occurring in 168 patients. It was 26.6 per cent if we combine emergency and clinic cases and severe and mild (Eden classification) cases. "The mortality was highest in the small group with known preceding hypertensive disease or nephritis, 61.5 per cent, intermediate in the patients with unknown past history 28.1 per cent, and lowest in the group with eclampsia known to be uncomplicated by preceding vascular or renal disease 10.3 per cent."[28]

I reviewed two series of 400 cases of "toxemia." The mortality in the 25 per cent and 8 per cent convulsive cases in the respective series was practically the same, namely, 25 per cent in each. The maternal mortality in the non-convulsive cases was 2.5 per cent. From these figures certain opinions may be deduced. That we have saved no eclamptics by altering our treatment of eclampsia since the days long ago when accouchement forcé was abandoned. That such women sick with severe "toxemia of pregnancy" as we have saved have been saved by stopping the progress of the disease before eclampsia supervened by interruption of pregnancy. That when the toxemic crosses the convulsion line on the diagram (Diagram 11), if she is in our hands, her chance of dying jumps from 2.5 per cent to 25 per cent. This is not to say that the convulsions in themselves are responsible for the multiplied risk, it is only to say that they serve as an excellent index usually of the destruction already wrought by the disease. It is clear that certain factors other than treatment enter into reported mortality of eclampsia. These are: veracity of the reporter, selection of reported cases and length of series, severity of the disease possibly different in different places and at different times in the same place, and time of hospitalization. In any event, except in highly selected cases and those reported by men obviously talking about something different from our sort of eclampsia, the mortality is always appreciably greater in eclampsia than in preeclampsia. Since I use the convulsion as an index of the severity of the disease and since the mortality multiplies by ten for us or (three or five or seven for others) after convulsions appear, and since removal of the products of conception is the first step in checking the condition because pregnancy is the sole sure etological factor, I conclude that I will attempt to empty the uterus of each case of preeclampsia before the patient has convulsions. The first point to consider apropos of this is how to decide *when* to interfere. Reference to the diagram of the disease (Diagram 11) regarded as a progressive whole shows, (as illustrated by the four point arrow) that patients either improve, stand still or grow worse in signs and symptomatology under observation and treatment. As indicated by the position of the lines broken for emphasis in my opinion torpor and irritability, mental but especially physical, best exemplified by the finger vaguely scratching at an itchy nose, index the last point at which one can interfere with a good chance that the patient will never cross the "convulsion line." In summary: I interfere on progressive signs and symptoms irrespective of the baby, especially

if I observe the preconvulsion and precoma signals of irritability and torpor. The treatment of preeclampsia should be as radical as the treatment of eclampsia should be conservative.

I now discuss different features of the various medical treatments applied to preeclampsia and what may be expected of them. I have the impression but am not sure that aside from all other classifications of preeclampsia, there are two distinct varieties from the point of view of medical treatment. These are preeclampsia of neglect and preeclampsia developing in spite of good care. In those of neglect rather often good results may be expected by hospitalization and medical treatment. In those developing in spite of good care, except usually for a transitory improvement, I have come to feel little of permanent recovery can be expected from hospitalization and medical treatment as a rule, and that the condition usually progresses along the lines of the chart with varying degrees of speed. This point should never be lost sight of in the history; based on it the noted usual transitory improvement in the cases developing under good care may be utilized, as soon as the subsequent down turn begins as a wise moment for interference of whatever sort selected. The patient is thus "peaked" for obstetrical intervention.

Many of the staple items in different widely accepted conservative methods of treatment when applied to preeclampsia seem to me objectionable on the grounds that they tend to mask the very signs on which the prognosis of impending convulsions depend. On occasion, certain of them apparently precipitate the convulsion. Morphia in any quantity produces torpor and its aftermath may be irritability—thus the two cardinal signs of impending convulsions are falsely produced by its use in preeclampsia. Headache may result from its use. Magnesium sulphate in quantity and concentrated given by mouth should and often does produce vomiting; only true preeclamptic vomiting possesses prognostic significance. Thus the value of this sign may be destroyed by the free use of epsom salts. Seven to fifteen watery movements each twenty-four hours is not conducive to rest and peace of mind so stressed as an essential part of the "conservative treatments." Epsom salts in the large amounts frequently used causes distention and an irritable bowel and perhaps a bowel more pervious to microorganisms if for any reason the patient comes to laparotomy. Hirschfelder[29] states that there is a clinical syndrome of high plasma magnesium accompanied by somnolence or coma, and that this may be induced in patients with renal insufficiency by the oral administration of one or more purgative doses of epsom salts and that many cases of coma in patients with renal insufficiency diagnosed uremic coma, may be simply magnesium coma induced by epsom salts purgation. He states further: "Our experiments on animals showed that animals whose plasma magnesium was only slightly raised (to .5 mg. or more) were much more sensitive than normal animals to ordinary doses of morphine."

Starvation and its kin the milk diet should substantially increase the sometimes existing tendency to acidosis (or "relative alkalinity") common to a certain group of these cases. This indeed is readily controlled by the glucose needle. Needles are an irritant and an exasperating psychological prick to the not so sick feeling patient with preeclampsia. The stomach tube may disturb the patient. Apparently, convulsions may be brought on by colonic irrigation. In short, certain common items used in the so-called "conservative treatments" of eclampsia seem to me for these reasons to be objectionable when used in preeclampsia. I prefer to put the patient to bed in a single room, insure good sleep in quantity, give a light mixed salt free diet, move the bowels adequately in a gentle manner from above and below, use balanced fluids, or if the patient is edematous, less intake than output, shut out relatives and friends, watch her constantly by per-

sonally taken frequent blood pressure readings and daily or bidaily personal urine observations supplemented if possible by Esbach estimation of albumin, and trust to interference with the pregnancy on the grounds noted when and if it becomes necessary.

I cannot see that it is the wisest course to treat any patient by a routine since each patient's reaction differs to the same treatment. Still less can I see the wisdom of permitting interference after an arbitrary interval of so many hours unsuccessful medical treatment, since each patient "peaks" at a different time. In the instance of a preeclamptic patient entering a hospital apparently nearing convulsions, distinct differences of authoritative opinion exist concerning the wisdom of immediate obstetrical interference as against palliative treatment for a period of time by conservative methods used in established eclampsia (plasmapheresis or venesection, intravenous magnesium sulphate, morphia, etc.). There is much to be said on both sides. In defense of immediate intervention are the mortality figures quoted against antepartum eclampsia and in favor of the intra and postpartum variety. In defense of palliative treatment are two outstanding facts, (1) that the patient is a poor risk for intervention and it in itself may precipitate convulsions, and (2) that brilliant results on occasion are seen to follow plasmapheresis or venesection, or magnesium sulphate intravenously or intramuscularly, or in lesser degree other conservative measures, in that the patient rapidly improves and continues to do so. I am of the opinion that in principle palliative treatment for a not set number of hours but until the patient is "peaked" (or continues steadily to improve) is best. A study of my own cases shows that I have almost always followed this practice. On occasion, however, so certain has it seemed to me that the patient would develop eclampsia that I have intervened forthwith in an attempt to force her into the intra or postpartum group with its better mortality. Such patients do not always develop eclampsia; whether as a result of intervention or because they were not fated to is arguable. At times, I have had a feeling that intervention with its usual accompanying drop in blood pressure had (with immediate subsequent treatment) prevented eclampsia. This point is a nice one and should not yet be argued too dogmatically.

I have considered specifically why interference is wise and when it is wise. We must now consider how it is best accomplished. This involves my personal experience. In my very beginnings it was still the custom to assemble the Staff and take turns with the metal dilator to divulse the cervix. The results of this require no comment. From that we took to the Voorhees bag and when I graduated from the hospital I was firmly convinced that the answer for all "toxemic" interference lay in that soft instrument. After seven years experience with the bagged, conical, untaken-up, partially dilated cervix with accompanying manual dilatation, high forceps and version, torn cervices, bleeding, and sepsis, I gave up the use of the Voorhees bag for induction in preeclampsia. I abandoned vaginal hysterotomy after a short trial because of its limitation of application, its occasional technical difficulties, the relatively long time I took at it and a high septic rate with it in our hospital at that time, and without trying multiple cervical incision because it did not appeal to me, I adopted the plan of emptying the uterus of a progressing case of preeclampsia, with anything less than the most favorable cervix (and these when I felt convulsions were imminent), by abdominal hysterotomy. Time, experience, and the relatively successful use of rupture of the membranes as opposed to the use of the bag for induction of labor has somewhat modified this practice—to what extent will be apparent. It can be said with certainty that the indiscriminate use of abdominal hysterotomy for preeclampsia will give worse results in a long series of cases than rupture of the membranes with (or without if possible) the guarded use of a low pressor principle oxytocic. Only by careful attention to analgesics and anesthetics, to tech-

nique, and to the hour by hour treatment of the underlying condition is abdominal hysterotomy a wise procedure even in selected preeclamptics. I think no sensible man chooses to enter the abdomen to deliver a patient who is obviously a poor surgical risk. A patient with blood pressure of 200, solid albumin, edema, frequently fat, is a poor surgical risk. The fact that forty-eight times I have done abdominal hysterotomy (about 25 per cent of all my sections) on somewhat such cases merely means that forty-eight times I have thought, in the light of my own and observed experience, that it was the best way out of a bad situation. I have always had misgivings. This does not mean that I section all cases of preeclampsia in whom I deem interference wise. In what I estimate to be considerably more than two-thirds of the cases, circumstances of the mother in relation to other live children and her condition and the state of the cervix permit me to induce the patient from below with the idea, especially if the baby is premature, of getting a normal, non-operative delivery. In some instances, the patient fortunately goes into spontaneous labor while under treatment and is then left strictly alone.

The baby of a primipara diagnosed as a "preeclamptic" may be of extraordinary importance to its family in that it may be the patient's only opportunity to have a child. This because in many instances of the sort, it is not possible to predict the final situation of this mother in respect to the nephropathies, and on this depends in large part her prospects for other babies. So, too, in multiparae who have lost one or more babies in previous pregnancies associated with "toxemia" the baby may be of vast importance. However, it must be borne in mind that abdominal hysterotomy in preeclampsia does not guarantee a living baby, especially if it be premature. Clifford[30] has shown a 45 per cent mortality in infants under five pounds in cesarean sections done for this condition; a mortality of 27 per cent in the infants in this group that weighed from four to five pounds. These figures are from the clinic of the Boston Lying-In Hospital.

With regard to maternal mortality figures in general on abdominal hysterotomy in preeclampsia we have the following at hand: Plass[31] has shown recently a 6 per cent maternal mortality in 67 sections for preeclampsia done throughout Iowa in 1930–1932. Smith[32] of Boston reports a similar series of 57 cases with a maternal mortality of 5.3 per cent. On the other hand, the writer, paying especial attention to anesthesia with the omission of all preoperative medication and a technique of operation which exposes the baby to practically no anesthetic and the mother to very little, has performed 48 sections for severe preeclampsia with the death of a single mother, a rate of about 2 per cent. Of the babies in this series, 13 weighed between four and five pounds and were all discharged well from the hospital. Babies under four pounds, 8 in number, were all thirty weeks or less and all died. Babies over five pounds, 27 in number, all lived but one. The mother of this baby had preliminary medication including morphine forty-five minutes before operation. It may be added that 4 of the 48 preeclamptics developed eclampsia. The patient who died was in this group. She was an emergency patient who had been sick for four weeks before entering the hospital. She had a plasmapheresis after delivery with a low pressure, had to be transfused following it, remained in coma and died. Autopsy findings were such that it might be argued that she would probably have died irrespective of the method of treatment. Figures and comment on this series follows:

	PARITY
29	Primiparae
19	Multiparae as follows:
	12 Para II
	2 Para III
	3 Para IV
	1 Para V
	1 Para VI
48	

Previous Dead Baby. Eleven of the 19 multiparae had a history of a dead baby

in one or more previous pregnancies. Two other essential primiparae gave a history of very early miscarriages.

Previous Eclampsia. Five of the 19 multiparae gave a history of eclampsia in a previous pregnancy. One had had it twice before.

Previous Toxemia. Nine other multiparae gave a history of toxemia in a previous pregnancy. In two others, this was suspected but could not be established.

Eclampsia in Subsequent Pregnancy. One patient developed eclampsia in a subsequent pregnancy. In her first pregnancy, I sectioned her in consultation at short eight months with a five pounds, fourteen ounce baby. In her second her physician carried her nearly to term with more pronounced symptoms and an eight pounds, eight ounce baby. She had six convulsions beginning nineteen hours after delivery and recovered.

Recent figures from the New York Lying-In Hospital are of interest in connection with this discussion. From 1932 through August, 1936, 131 preeclamptics and 26 eclamptics were treated without maternal mortality. Approximately 30 per cent of the preeclamptics had pregnancy artificially interrupted. Of these interruptions, 22 were by Voorhees bag, bougie or artificial rupture of the membranes in about equal numbers. Sixteen had cesarean section but only 11 of these were done primarily for preeclampsia. It may thus be seen that in that hospital to date, two-thirds of the artificial interruptions of pregnancy were done from below and one-third from above. In the preeclamptic series 9 babies weighing four pounds or more were stillborn, deadborn or neonatal deaths, approximately 7 per cent. It is further interesting to note that the ratio between preeclampsia and eclampsia in this series is 5:1. This is quite different from the ratios reported in the original series of 801 cases occurring in the Johns Hopkins Hospital in the six years ending May 1, 1929. In that series, preeclampsia was given 9.2 per cent and eclampsia 12.5 per cent of the whole series. The present figures from the New York Lying-In Hospital correspond more closely to our experience and fit in better with the idea of the qualitative identity of the two conditions.[33]

So it may perhaps be concluded that abdominal hysterotomy done with special precautions, for special reasons, including one's own interpretation of what constitutes that mirage-like entity "the favorable cervix" has a place in the treatment of preeclampsia. But as a warning to enthusiasts for this procedure stands the apparently inevitable yearly list in each state's maternal mortality statistics, "Toxemia—Cesarean Section—Peritonitis," and the opinion of sound, conservative obstetrics epitomized in the words of Irving. He says, "Cesarean section is rarely justified in preeclamptic toxemia and is frequently an admission on the part of the obstetrician that his haste to evacuate the uterus has obtained the upper hand of his common sense and resourcefulness" unless the patient has some other indication for section or is a primipara with a long rigid cervix. He says, "Patients so treated are just as likely to have eclampsia as those on whom labor has been induced."[3]

One condition in pure preeclampsia deserves special mention. Teel, Reid and Hertig[34] in a paper entitled "Cardiac Asthma and Acute Pulmonary Edema as Complications of Non-Convulsive Toxemia of Pregnancy" made a study of 6 patients with this syndrome and reached the following conclusions: (1) Six case histories are presented in which severe non-convulsive toxemia of pregnancy was complicated by sudden paroxysms of dyspnea accompanied by acute pulmonary edema. In 5 of these cases the patient suffered from a simple preeclampsia without preceding hypertension or nephritis. (2) The attacks all came on in patients at bed rest under treatment, and closely resembled classical cardiac asthma. (3) The immediate prognosis for patients who develop this symptom-complex is grave. If they survive

delivery and the early puerperium, the ultimate outlook as regards chronic cardiovascular and renal disease seems to be good. (4) Left ventricular failure may be an important factor in the precipitation of these attacks of "cardiac asthma" in patients with severe preeclampsia. It may also play a dominant role in the production of acute pulmonary edema in eclampsia. The fact that a number of our preeclamptic patients recovered indicates that such left ventricular failure is not necessarily an agonal phenomenon. (5) If overloading of the left ventricle plays a role in the production of acute pulmonary edema in certain of the severe and fatal cases of preeclampsia and eclampsia, some caution should be exercised in the use of methods for rapid mobilization of edema fluid in patients with severe toxemias of pregnancy as well as eclampsia. It might also be advisable to digitalize all eclamptics and those patients with severe toxemia over thirty years of age.

It was my good fortune to deliver 3 of the recovered patients studied in this report, and to see one of these through a subsequent normal delivery eight years later. Since such patients are reported rarely my clinical impression of them may be recorded. They are multiparae with obstetrical histories negative for "toxemia." They are in the thirties. They have immediate histories of prolonged preeclampsia, (4, 4, 2, 2, 5 weeks) with or without treatment. They have marked albuminuria, variable hypertension, marked edema, variable blood uric acid (3 to 5.7), N.P.N. usually not elevated (27–46). In the 3 that I saw the symptoms of preeclampsia were so marked that I felt interruption should have been done on general principles prior to the attack of cardiac failure. These cases for treatment must be distinguished from essential hypertension with cardiac failure. Since the preeclampsia has been unsuccessfully treated in these patients the only treatment left is to empty the uterus. Common sense, and my experience with this small number of cases indicates that treatment of the cardiac condition with morphia (?) and rapid digitalization should precede obstetrical intervention but that there should be no delay once the patient is improved, since she may die in a repetition of the first attack and the underlying cause persists. As a matter of fact, this was accomplished in the 3 patients twice by rapid abdominal hysterotomy, and once in a three hundred pound woman by bougie and pack. These patients were very sick not only at the time of cardiac failure but in and around the period of delivery. One was unquestionably operated without sufficient time for the treatment of the cardiac condition to be wholly effective. Aside from this, the most important practical considerations brought out by this study are (1) that too rapid mobilization of edema fluid in preeclampsia is perhaps not without danger and (2) a probable explanation of the way in which most eclamptics die.

Treatment of Eclampsia. It is the generally accepted opinion that some one or other of the so-called conservative routine methods of treating the eclamptic state once the patient has developed convulsions (or coma) gives far better results than active obstetrical intervention. Further it is generally stated that cesarean section is, next to the long abandoned accouchement forcé, the method of treatment attended by the worst results. Yet, one discovers that in most of the accepted routines, some form of interference is permitted after so many hours or days of conservative treatment if improvement is not noted or the patient grows worse; and in studying many series of eclamptics treated conservatively, on occasion the method of interference used appears to be cesarean section, so that we must conclude that it has a place, rarely at least, in the treatment of eclampsia also, after failure of conservative treatment. Late figures, quoting Plass again, show that of 84 cesarean sections done for eclampsia in Iowa in 1930–1932, 16 died, a mortality rate of 19 per cent. If we compare this maternal mortality of eclampsia treated by

cesarean section all over one state, which perhaps implies in some instances at least a lack of detailed care, with the figures given earlier in this essay from an individual series treated in a variety of ways but practically all "conservative," we find that these cases treated by section give equally good results as our "under observation" group and twice as good results as the "emergency group." No fair conclusion can be drawn from these comparative statistics for a variety of reasons. The purpose of stressing them here is to emphasize that method of treatment and method of delivery in eclampsia are two, on the whole, separate propositions though they sometimes interlock. The question of method of delivery resolves itself into adding the least possible insult to an already heavily damaged body. From a practical point of view no delivery at all, or normal delivery when possible, does the least mischief. How much more eclampsia a given patient will take and live, and how a given doctor views this aspect of the question is an individual matter, and no routine can be laid down that meets the requirements of all cases. This is justifiable criticism of all "routine conservative treatment." Constant observation, treatment including rest, and individualized action depending on the results of these, will give the best results in eclampsia.

Among the untold number of remedies for and treatments of eclampsia, two deserve special mention. It has been shown that a relatively small proportion of eclamptic deaths result from cerebral hemorrhage, perhaps 10 per cent to 15 per cent. Such deaths are apt to occur in elderly women, probably with hypertension background. A few survive to die of lung or other sepsis. The rest die of, or with, edema of the lungs or brain, or both. The typical moribund eclamptic is clinically a cyanotic woman with wet lungs and running fluid from the mouth—the head lowered for drainage.

As already stated, Teel, Reid, and Hertig[28] have shown that a few preeclamptics exhibit acute left ventricular failure, seemingly the result of the prolonged hypertension of the preeclampsia and not associated either with chronic nephritis or chronic heart disease. It seems likely that the wet lung moribund eclamptic is in the same state for the same reason. From the frequent findings of cerebral edema at autopsy and the common clinical observation of edema of the lungs, it may be laid down as a sound principle that any treatment which may increase edema is unsound. Hence, the theory of balanced fluids or dehydration by still more fluid limitation[35,36] in the eclamptic state deserves special consideration. Since it is known that the damaged kidney will excrete only what fluids its condition allows, more fluids than this amount taken in must increase edema. If it is true on the above reasoning that increased edema is bad, then it may be reasoned that any agent which tends to reduce edema, within the limits already suggested, is good. It seems to me the use of magnesium sulphate intravenously or intramuscularly most directly fulfills this requirement. Stander states that 6 grams of the drug may be given in twenty-four hours provided not more than 20 c.c. of a 10 per cent solution are administered at a single dose. Hirschfelder, previously quoted in respect to mouth administration of epsom salts in preeclampsia,[29] specifically states intravenous or intramuscular magnesium sulphate in the customarily used doses is not open to the same objections as by mouth because the relatively small dose does not result in dangerous concentrations of magnesium in the blood. Lazard[37] reports 225 cases treated by intravenous magnesium sulphate with a gross mortality of 13.3 per cent.* Schwarz and Dorsett[38] of St. Louis (1930) report 186 cases of eclampsia treated basically with intramuscular or intravenous magnesium sulphate with a maternal mortality of 7 per cent. McCord of Atlanta reports good

*Lazard, Personal Communication, 328 cases, gross mortality 12.8 per cent, corrected mortality approximately 9 per cent.

results by this method. Most impressive to me in American reports is the work of Rucker[39] of Richmond. He has so treated 127 consecutive eclamptics[40] with 6 deaths, a mortality of less than 5 per cent. He says of these cases (and publishes the findings of each case), "In only two cases was I unable to stop convulsions." And further to show that his mortality is not a corrected one, "Of the six deaths that occurred in the 127 cases of the ultraconservative group, two were not treated ultraconservatively, two died of infections after the eclampsia had subsided and only two were truly eclamptic deaths treated in the manner described." Added weight is given to these results by comparison with two previous series in his own hands. Active intervention gave him a 31.6 per cent mortality. Morphine, venesection, gastic lavage, colonic irrigation and treatment otherwise conservative gave a 25.9 per cent mortality.

In summary, I believe the treatment of eclampsia, on the basis of necropsy findings and statistics in our present state of ignorance of the cause consists of magnesium sulphate intravenously, limitation of fluid and not too rapid dehydration, rapid digitalization and rest. By rest I mean lack of continuous treatment and the use of the barbiturates if magnesium sulphate intravenously fails to insure quiet. Sharp individualization in method and time of delivery, without deviation from the mother's interests for those of a problematical baby, is necessary. No routine applied either to medical or obstetrical treatment will give the best results. I think that on occasion such divergencies from the suggested principles as elimination, morphia, plasmapheresis or venesection, glucose solution exceeding the output, and even abdominal hysterotomy, will offer the individual patient the best chance. As in preeclampsia, all obstetrical manipulations must take into account the matter of anesthesia—no anesthesia at all, i.e., local must, at least in theory and can frequently in practice, be used. Spinal is debatable in pregnancy. Short gas oxygen with a very small amount of ether if necessary has in my hands seemed to do no harm in spite of theoretical objections.

It is my conviction that the most popular so-called conservative routine treatments of eclampsia have been widely adopted and extolled not because of any great intrinsic merit. They are harmless relative to the method of abrupt and shocking intervention which preceded them. They have lowered mortality in large measure by abolishing this. Most items used in routines of treatment have a place at times in the treatment of this or that patient with eclampsia to meet a given condition and to be abandoned when the object has been accomplished. It seems absurd to treat a patient by posting on the wall a blanket order for so much of this or that at such an hour irrespective of the way the patient responds. And more absurd when none of the therapy is specific.

The cardiovascular and renal sequels of preeclampsia and eclampsia need extended study. What proportion of the group of patients showing these changes subsequent to the eclamptic state got them as a result of the toxemic pregnancy alone is far from clear. The older literature on the subject is familiar, some of it not convincing. For a recent consideration of the matter, in which certain fundamental conditions are laid down for determining the truth regarding this question, the reader is referred to a paper by Teel and Reid.[28] The behavior of patients in subsequent pregnancy has been recently considered by S. Kjelland Mørdre of Oslo[41] as follows:

The author deals with the much discussed question of the prognosis with respect to subsequent pregnancies and parturitions in patients who had suffered from eclampsia previously. The material comprises 61 cases of subsequent pregnancies and deliveries in 48 eclampsia patients, all of whom formerly had been treated in the gynecological department of the Riks-Hospital in Oslo. Nine of these patients were pregnant but free from symptoms. As to the rest the situation was

as follows: Among 52 pregnancies ending with parturition 30 were complicated by recidivations of pregnancy intoxications, as albuminuria, eclampsism and eclampsia in 18, 5 and 7 cases respectively. The severity of the recidivation was slight in 11 cases, medium in 5 cases and serious in 14 cases. One death occurred due to the premature detachment of a normally situated placenta (abruptio placentae).

As to the children definite information was available in 49 cases; 36 were alive and viable, 28 of whom were mature; 2 premature but viable children died one and one-half days after birth; and 11 were stillborn, whereof one was mature and 7 were viable, but most were macerated.

The author strongly emphasizes that the interruption of the new pregnancy (abortus provocatus) in most of the cases is not necessary. The question has to be solved individually in each case, and he mentions a number of factors which he thinks to be of significance for the purpose (e.g. the blood pressure).

This ends the consideration of those diseases which we have chosen to place in our classification. For the sake of completeness certain other allied conditions may be spoken of in a brief and clinical way.

My experience with acute yellow atrophy in pregnancy has been small; the cases so far as I know have died, except for two with salvarsan liver. I have seen patients diagnosed as eclampsia and as pernicious vomiting who were jaundiced, and I have seen 2 or 3 of these recover. It may be that the diagnosis should have been acute yellow atrophy, but how to make it unless the patient dies, puzzles me. In practice, I have always taken the attitude that a pregnant woman jaundiced had better be left alone obstetrically and treated medically if any basis for medical treatment could be seen with the idea that if she had acute yellow atrophy, she would die anyway, whereas, if she had catarrhal jaundice, she might die of hemorrhage if delivered before she recovered. The patients with the salvarsan liver that I had the opportunity to observe was sent to us from the general hospital where they had obtained treatment, for immediate emptying of the uterus. The jaundice disappeared, and each gave birth to a child three months later. It may be noted that to empty the uterus is not a sovereign remedy for all medical ills in the pregnant woman.

VOMITING OF PREGNANCY

The question of whether or not "pernicious vomiting of pregnancy" is "toxemic" is unanswered. The following resume of the pathology in a small series of cases autopsied by Hertig at the Boston Lying-In Hospital is presented as a contribution to this question.

The pathological lesions of fatal hyperemesis gravidarum have been generally stated to be those incident to starvation. Inasmuch as the clinical and pathological pictures do vary somewhat, as judged by the 6 cases autopsied in this clinic during the past five years, this general statement would not seem to be entirely accurate. A brief survey of the pathological findings of these 6 cases follows together with a special reference to one case of late pernicious vomiting whose pathological findings were significantly different from those in the other cases.

The only possible significant heart lesion in this series was edema of the myocardial stroma, occurring in 3 of the cases, including the "atypical" one. The lungs were uniformly the seat of a variable degree of pulmonary congestion, usually moderate in amount. The spleen, as in eclampsia, showed gross softening, congestion and occasional hemorrhages but in no case did it show evidence of the follicular fibrinoid lesion seen in such "toxic states" as eclampsia, diphtheria or streptococcal infections. The liver change was predominantly one of a fatty nature, there being fairly large amounts of fat in the central portion of the lobules. Petechial, subcapsular and portal hemorrhages occurred in one-half the cases while rare, isolated, necrotic liver cells were found in various parts of the lobule. There was no characteristic picture in the kidneys. The 5 early vomiters showed only old chronic pyelitis and cloudy swelling or cloudy swelling alone, but the late vomiter showed an entirely differ-

ent picture in the kidney: glomerular thrombosis, fatty degeneration of glomerular epithelium and endothelium, and focal necrosis of convoluted tubules with fatty degeneration thereof. The glomeruli varied from those with ischemia to those which were congested. The adrenals in half the cases were congested and contained petechial hemorrhages. The uterus was uniformly negative. The brain was examined in only 5 cases and was negative twice, slightly edematous but without congestion twice, and edematous but congested once. In only one case (with congestion and edema) was there a toxic encephalitis: i.e., ganglion cell degeneration, satellitosis about the ganglion cells, recent capillary thrombosis, and perivascular lymphocytic infiltration.

It would seem, therefore, that the pathological picture in toxic vomiting, at least in our experience, is not as constant as in the other great group of toxemias; namely, eclampsia and its allied types. That "toxic" changes in various organs such as the brain (toxic encephalitis), kidney (fatty degeneration of tubules and glomerular thrombosis), to a lesser extent the liver (foci of necrosis), is evident from our small series. It would also appear that this type of toxemia is more variable, pathologically, but that much of the change seen in the average case could be ascribed to starvation and rapid postmortem autolysis incident to the lowered alkali reserve associated with vomiting.

This bit of pathology bears out the observed clinical distinction between the common early and the rare late vomiters. Much is heard of the former, little of the latter. The late (24–32 weeks) vomiter is a clinical entity and a dangerous one. She may and usually has vomited too much or too long in early pregnancy and then her vomiting has stopped or is only occasional. More or less abruptly, it has begun again and the patient enters the hospital sick and apathetic. In the past, partly because of the rarity of the condition and partly because a little more time might give a baby developed enough to live, we have lost these patients by procrastination. Such cases are not to be confused with acute yellow atrophy or with vomiting of preeclampsia, and I have always been at loss to know where to fit them in to the scheme of things. Judging by a comparison of these pathological findings, they may be thought to represent a transition stage between early pernicious vomiting and the eclamptic state. Where they ultimately fit remains to be seen.

Treatment of Pernicious Vomiting of Pregnancy. Over the period of my obstetrical experience, the treatment of severe vomiting of pregnancy has steadily improved. Fewer deaths have occurred and fewer abortions have been necessary to prevent deaths. With added individual attention to these patients and to each of the indications produced by the condition, and less resort to routine methods to be carried out by a variety of house physicians, our hospital results in the last two or three years have shown a marked further improvement. Tube feedings (in the duodenum or the stomach) after sufficient sedation have directly met the patients' starvation. In the last 59 consecutive cases there have been no deaths and only 2 therapeutic abortions, a far better record than in any previous years. Patients that we formerly would have aborted in desperation, many of whom no doubt, would have died, have recovered under this treatment, nor have we seen the patients as formerly who, though they stopped vomiting, went on to die. Tube feeding permits the immediate administration of the vitamins protective against the neuritis of starvation. This method of treatment, furthermore, keeps down the number of deaths resulting from religious convictions since the question of therapeutic abortion need seldom be raised.

TOXIC SEPARATION OF THE NORMALLY IMPLANTED PLACENTA

Regarding this entity, I shall only discuss the treatment. The concensus of opinion in America seems to be that the wisest treatment for toxic separation of the placenta, baby alive or dead, unless the cervix is fully dilated is immediate abdominal cesarean

section coupled with immediate replacement of lost blood by transfusion. For a long time I held the same opinion and in a small series of personal cases had satisfactory results, with the death of one woman only. She proved to have an eclamptic liver at autopsy though she had no convulsions. However, J. A. Smith[32] reported from the Boston Lying-In Hospital on 42 toxic (of 76 cesareans done for separation of the normally implanted placenta) premature separations as follows:

Since this group of 42 patients shows a mortality of 21 per cent (9 deaths), they are reported in some detail. Roughly, one-third were primiparae. Two patients had convulsions antepartum and both died. Thirty-six patients were delivered by the classical operation with 6 deaths; 2 by the Kerr operation with one death (in this case hysterectomy was done seven hours after delivery); and in 4 cases the Porro operation was done with 2 deaths. Thirty-nine were done under gas-oxygen, ether anesthesia with 8 deaths, 3 under local anesthesia with no deaths, one under spinal anesthesia with one death. Three fatal cases and 3 recovered cases were transfused at the time of operation. One fatal case was transfused on the seventh day and one recovered case on the twenty-eighth day. The essential facts in the 9 fatal cases are given briefly below.

1. Para IX. Nephritis. Oliguria. Died on seventh day in uremia. No autopsy.

2. Para IV. Toxemia without convulsions. Died suddenly seven hours after operation without evidence of hemorrhage. Partial autopsy showed hemorrhages in liver and severe nephrosis.

3. Para II. Convulsions. Oliguria. Died on seventh day in coma.

4. Para I. Toxemia without convulsions. Died on eighth day of peritonitis. Autopsy.

5. Para I. Convulsions. Died four hours after operation without evidence of hemorrhage. Autopsy showed liver necrosis.

6. Para V. Toxemia without convulsions. Died in thirty-six hours, anuric, twitching, apparently on verge of convulsions. No autopsy.

7. Para III. Toxemia without convulsions. Suppression of urine. Died three hours after classical operation. No autopsy. Diagnosis shock. No external hemorrhage.

8. Para XII. Toxemia without convulsions. Oliguria. Died on sixth day. Sepsis and uremia. Autopsy.

9. Para V. Toxemia without convulsions. Laparotomy seven hours after delivery because of suspected internal hemorrhage which was not found. Uterus removed although there had been little external bleeding postpartum. Died on third day. Autopsy showed acute hepatitis and pregnancy nephrosis.

There are three noteworthy facts about this small group of patients. They have an extremely high mortality; hysterectomy is infrequent, although the opportunity afforded of removing the uterus has often been advanced as an argument for delivering this type of case by cesarean section; there are no deaths clearly due to hemorrhage. There would seem to be a reasonable doubt as to whether cesarean section is the best method of delivering these patients.

In connection with Smith's conclusions, I may say that I have yet to be obliged to take out a uterus in hysterotomy for toxic separation. With these figures based on a considerable experience with the worst type of cases, it was reasonable to seek some other method of treatment. The policy of doing sections was continued if the baby was in good condition and sufficiently advanced in pregnancy to grant its survival. Otherwise, tight cervical and vaginal pack and pressure over the fundus in the form of a Spanish windlass (Rotunda treatment) is followed by expectancy and treatment of the patient's condition as she requires. This automatically results in treating the poor risk patient by the vaginal route and reserves abdominal hysterotomy for patients in relatively good condition with a baby which is of good size and which has shown no marked evidence of fetal distress. Comparative statistics are perhaps not yet in order, but results to date have been satisfactory. Until one sees for himself the working out of this procedure, he is sceptical. Personally, from the opposite point of view, I am convinced that it is worthy of extended trial. We know that some of these patients will die from their toxemia (vide Smith) no matter what is done, but by this method patients do not die of shock and

the added hemorrhage which is inevitably the accompaniment of hysterotomy. A Scotsman from Munro Kerr's clinic in Edinburgh, visiting the hospital this summer, said that often these patients ceased to bleed after simple rupture of the membranes, and spontaneous delivery took place without packing, thus reducing the risk of sepsis. About this time I packed such a patient who was in very poor condition from blood loss. For twenty-four hours I treated the patient. Labor had not started at the end of this time, and I removed the pack with the idea of repacking. There was no bleeding so I left the patient as she was. Within the following few hours, she delivered herself spontaneously without hemorrhage either during labor and delivery or afterwards.

SUMMARY

No conclusions can be drawn from this paper. It constitutes a highly personal picture of the problems involved in "The Toxemias of Pregnancy." Some progress has been made in the subject in the twenty odd years that I have viewed it—much more in the last ten years than in all the time before—but it is still in a far from satisfactory state as proved by the persistence of its maternal and infant mortality rate. Further careful study is needed. Practically this should take the form first of an effort to approach it from a common point of view and with a common terminology, and second, group study should invariably be conducted by the closely knit cooperation and effort of obstetrician, internists especially interested in the cardiorenal aspects of the problem, and the pathologic, metabolic and endocrinologic laboratories.

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CHRONIC NEPHRITIS COMPLICATING PREGNANCY*

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DURING the past ten years a rather marked change has taken place in obstetric opinion concerning the toxemias of pregnancy. The majority of such cases were then termed "preeclamptic toxemia" and if delivery and the early puerperium were not attended by convulsions the patients were dismissed from consideration until the occurrence of another pregnancy. In only a few instances when the presence of marked renal or vascular changes made immediate recognition easy was the diagnosis of "nephritic toxemia" made and even then the true effect of gestation on the disease process was not realized adequately. Recently, however, many maternity services have inaugurated a series of "toxemia clinics" whose function it is not only to care for toxemic patients during the antenatal period but to include repeated visits for examination and investigation for months or even years after delivery. As a result of this prolonged follow-up study, three essentially new features have been added to our knowledge of the so-called toxemias and have received fairly general recognition: (1) that a large proportion of those cases manifesting hypertension and albuminuria during pregnancy are on a preexisting chronic vascular basis; (2) that a considerable number of patients hitherto apparently normal but developing a severe toxemia during pregnancy will be left with permanent generalized arteriolosclerotic involvement; (3) that the course of a preexisting hypertensive vascular disease is accelerated markedly by pregnancy and the patient left in a much more serious condition than before.

It is realized that, strictly speaking, chronic nephritis complicating pregnancy should be considered as a medical complication rather than as a toxemia. However, the signs and symptoms of mild nephritis during gestation resemble so closely those occurring with toxemia, and the differential diagnosis between the two conditions is frequently so difficult, that it has become common custom to consider them under the same heading. Furthermore, it is suggested that the old term "nephritic toxemia" should be discarded as misleading and "chronic nephritis" should be adopted instead. Even the latter term admits a certain amount of criticism and in the majority of the cases which we are to discuss the most correct diagnosis would be "pregnancy complicated by chronic hypertensive vascular disease." Finally, it should be stated that included in this group of cases are not only those typical ones, usually far advanced, on whom the diagnosis may be made during gestation but also the earlier and milder instances where the true state of affairs is only revealed after months of careful observation subsequent to delivery.

Cases of nephritis, as seen and studied by the internist may be generally classified into three main groups, namely, hemorrhagic or glomerular nephritis; degenerative nephritis or nephrosis; and arteriosclerotic nephritis. The onset of hemorrhagic nephritis is usually acute and the disease may run a rapid and fatal course or go on to apparently complete recovery. On the other hand, it may become chronic, progress slowly, and after a period of years end in uremia. The course of nephrosis is ordinarily protracted, but recovery rarely ensues. Glomerular involvement occurs after a time and the terminal stage is associated also with uremia. The arteriosclerotic

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form of nephritis usually runs a prolonged course with hypertension as its essential feature. It is frequently quite asymptomatic and the development of definite signs and symptoms are often an indication of the terminal stage. In some cases cardiac involvement occurs and the immediate cause of death may be heart failure; in others, death may come from a cerebral accident or uremia. The renal involvement is usually only a part of a generalized sclerotic process affecting the arterioles of the entire body, and the condition is often aptly described as cardiovascular-renal disease.

Acute hemorrhagic nephritis and nephrosis are seen so rarely during pregnancy that they do not warrant consideration here. It seems sufficient to state that they should be regarded as serious complications and ordinarily justify radical interference with the gestatory process. Cases of chronic hemorrhagic nephritis are by no means uncommon but in the great majority of instances the nephritic involvement seen in pregnant women is of the arteriosclerotic type. Moreover, the differential diagnosis between those two forms of renal disease is not of particular importance to the obstetrician since the therapy, in so far as he is concerned, is essentially the same.

Frequency. It is difficult to arrive at an accurate estimate of the incidence of toxemias occurring among the childbearing population at large. Recent figures which have been conservatively adduced indicate that recognizable toxemic manifestations, although usually mild, may be found clinically in 10 to 15 per cent of all pregnant women. Moreover, if a series of toxemic patients are carefully followed for a period of months after delivery in order to determine whether they return completely to normal or are left with a chronic vascular process, it will be found that one-third will evidence the latter abnormality. Accordingly, it seems safe to state that between 3 and 5 per cent of all pregnant women have or will be left with chronic nephritis. The frequency of this serious complication, therefore, makes it particularly important. It may be stated in passing that the condition is seen most frequently in multiparous women and in those in the later years of their childbearing careers. Little if any difference in incidence is observed between the white and colored races.

Etiology. The etiology of nephritis itself is not well understood and we have no adequate explanation for the sudden and severe exacerbation of the chronic process which occurs during pregnancy. It has been stated frequently that there is an increased demand on the already damaged maternal kidneys since they must excrete the products of fetal metabolism. It is our opinion that this can by no means be the real answer to the problem since the change in the maternal condition begins to be noted very early in pregnancy and at a time when the product of conception is too small to add a significant load. Moreover, it is known that a great reduction in the amount of functioning renal tissue may take place without signs of insufficiency developing during pregnancy. This is evidenced by the repeated observation of normal pregnancy occurring in women who have undergone nephrectomy and the author has recently seen a triplet pregnancy in such a patient with no evidence of renal insufficiency whatsoever. That an exacerbation of the preexisting nephritis occurs early in the process of gestation and increases in severity until its termination, is clear, and affords an adequate explanation for the fact that the patient is left in a poorer condition than before.

Those instances of chronic vascular disease found after delivery in patients presumably hitherto normal but manifesting during pregnancy an acute toxemic condition seem somewhat easier to explain. During an acute toxemia a spasm of the arterioles occurs which may be seen on examination of the eyegrounds and is probably general throughout the vascular system. If this spasm persists for any length of time organic changes are apt to occur, and the process becomes sclerotic rather

than spastic. It seems plausible to assume that in such a manner arteriosclerotic nephritis might well be initiated.

Symptoms and Physical Signs. Except in advanced cases the course of nephritis complicating pregnancy is often insidious and very few symptoms occur to cause the patient to seek medical advice. The most frequent complaint is that of headache which tends to be dull and general rather than acute and frontal as in the true toxemias of pregnancy. Lassitude and general malaise are often observed, and in severe cases a blurring and diminution of vision manifests itself. Symptoms of cardiac embarrassment or failure may be more prominent than any others; backache is rather inconstant. Except when the cardiac symptoms predominate the patient often leads a reasonably comfortable existence.

Hypertension is found regularly but its degree varies greatly. An elevation of systolic pressure above 200 millimeters with a corresponding diastolic reading frequently accompanies the severe case but in others the level is much lower. Generally speaking, repeated blood pressure determinations upon an individual with nephritis will show rather constant readings, whereas in the true toxemias of pregnancy marked fluctuations may be observed within a short time. Albuminuria may be absent but usually occurs in varying degrees. It is our experience that massive albuminuria more frequently denotes a toxemia (preeclampsia or eclampsia) than chronic nephritis. The finding of casts in the urine is by no means a predominant sign. In far advanced cases diverse degrees of oliguria are found but frequently there is little if any alteration of the normal fluid-urine ratio. Edema, which may be marked and general, is usually present, particularly in late pregnancy. In the milder cases no abnormality in the blood chemistry is usually found while in the severer ones varying degrees of nitrogenous retention are seen.

There is a steady progression in the course of the disease as pregnancy advances. As term is approached occasionally eclampsia is superimposed upon the already existing nephritic process. Moreover, patients of this type seem peculiarly predisposed to the development of premature separation of the placenta. A few of the severer cases die during pregnancy or in the early puerperium from apoplexy, cardiac failure, or uremia. In most instances, however, delivery takes place without obstetric complications and the patient's general condition slowly improves. After a period of time a more or less stationary level is reached, but the nephritic process remains in a more advanced stage than it had been prior to the onset of gestation. Following this the disease pursues its steady course with death occurring months or even years afterward.

It should be emphasized that in the milder type of case or in the one resulting from an acute toxemia of pregnancy, the nephritis may run a protracted course unassociated with many signs or symptoms. Indeed, persistent hypertension may be the only sign and the development of definite symptoms and albuminuria occur only in the terminal stages. Frequently it is only by prolonged follow-up study that the true nature of the condition is ascertained.

Diagnosis. When the nephritic process is severe or is known to have antedated the pregnancy the diagnosis is, of course, simple. In the milder case, or when no previous record is available, it is frequently difficult or even impossible during pregnancy to determine the patient's status and often months or even years must elapse after delivery before a positive statement can be made.

The making of a definite diagnosis in each individual case, no matter how long deferred, is of the utmost importance since it carries with it a prognosis for future childbearing. If the patient has had a toxemia of pregnancy which eventually clears up entirely, a subsequent pregnancy is permissible. However, if the patient is nephritic or has developed chronic vascular disease as a result of a severe toxemia it

is imperative that her childbearing career be considered finished. On the other hand, it is most desirable to determine at once, during the pregnancy, whether the condition at hand is toxemic or nephritic. If nephritis is present the longer the pregnancy is carried the more grave will be the patient's condition afterward.

Unfortunately, as has been said, the differential diagnosis between a mild arteriosclerotic nephritis and low reserve kidney or preeclampsia is frequently extremely difficult. Symptomatology is of no avail, and blood pressure findings, amount of albuminuria, casts, or edema are essentially similar in the two types of cases. Even the results of careful chemical analysis of the blood usually give no information. Stander relies considerably on repeated studies of the renal function and states that the urea clearance and phenolsulphonephthalein tests, if consistently low, almost surely indicate chronic renal damage. In the author's experience only three factors are of particular value in rendering a diagnostic decision. In the first place, the majority of the true toxemias of pregnancy do not manifest themselves prior to the last lunar month and it is extremely rare to observe one prior to the seventh month. Conversely, the appearance of hypertension or albuminuria during the first two trimesters of pregnancy means that, with a very small margin of error, the process is nephritic in origin. Secondly, experience has shown that the so-called "repeat toxemia" is almost always on a nephritic basis, and that the true toxemias of pregnancy rarely recur. Thirdly, an extremely important aid in establishing a differential diagnosis consists of careful and repeated study of the eyegrounds. Spasm of the retinal arterioles, retinal edema, and occasionally hemorrhage or detachment are found in cases of toxemia of pregnancy. The nephritic case, however, will evidence arteriolosclerotic changes or albuminuric retinitis. In recent years we have come to rely more and more on the findings of the ophthalmologists in making a decision as to the basis of hypertension and albuminuria developing during pregnancy.

Prognosis. The question of prognosis may well be considered first from the point of view of the effect of the disease process upon the pregnancy itself. There is a distinctly increased tendency for the premature termination of the pregnancy either before or after the period of theoretical viability of the child has been reached. The placenta often contains white or red infarcts and a sufficient amount of chorionic tissue may be thrown out of function to cause the intrauterine death of the child. Smaller degrees of infarction often result in the birth of a child weighing much less than one would expect from its gestational age. These facts are important to remember when one is trying to carry the patient along until the child reaches a size which renders likely its survival after birth. In this connection it is of interest to note that the behavior of the child after birth tends to conform to its gestational age rather than to its actual weight and some of the smallest infants to be raised have come from nephritic mothers. As has been said the incidence of premature separation of the placenta is increased. The fetal and neonatal mortality (including abortions) in a large series of cases of this type investigated by the author was approximately 25 per cent. Such a gloomy prognosis renders still more doubtful the wisdom of attempting to carry a pregnancy complicated by chronic nephritis for the sake of the child.

The prognosis in so far as the effect of the pregnancy upon the disease is concerned is uniformly bad. It is true that the immediate mortality is not high, and in our experience less than 5 per cent of women whose pregnancy is complicated by nephritis succumb before delivery or in the early puerperium. This immediate mortality, as has been stated, is due to apoplexy, uremia, or myocardial failure. The truly appalling nature of the situation

can only be appreciated by prolonged and intensive follow-up study of the patients for several years. Thus, Stander and the author in 1931 found a death rate of 42.5 per cent in a series of nephritic patients followed for a period of ten years after a diagnosis of nephritis had been made during or shortly following a pregnancy. Furthermore, this figure represented a mortality from nephritis itself since deaths due to other causes were excluded. Such a finding together with similar observations by other authors has been responsible for the present radical treatment of cases of this type.

At this point, it seems fitting to discuss briefly the prognosis for patients suffering from one of the true toxemias of pregnancy from the point of view of their being left with a chronic vascular process. In a study of 74 eclamptic patients it was found that one year after delivery 17, or 23 per cent, showed definite evidence of nephritis. Sixty-one of these patients were subsequently restudied three or more years after delivery when the incidence of general vascular involvement had risen to 38 per cent. Obviously not all these women owed their nephritis to the eclampsia since the correct original diagnosis in many of them was undoubtedly "eclampsia superimposed on chronic nephritis." However, a careful study of the records would seem to indicate that a number of these patients had been entirely normal before pregnancy and first showed evidence of chronic vascular disease shortly after the convulsive attack. The remote prognosis of preeclampsia resembles that of eclampsia, although it is somewhat less severe. In a series of patients studied several years after an attack of severe toxemia which did not progress to the convulsive stage, 23 per cent of them evidenced vascular changes. In accordance with its postulation the prognosis following low reserve kidney is excellent since nephritis does not follow and the condition may not recur in a subsequent pregnancy. Obviously, many cases will leave the hospital with the diagnosis of "toxemia unclassified" and it is in this group that careful follow-up study is most imperative in order that the diagnosis of chronic vascular disease be ultimately made or ruled out and an intelligent prognosis for the future be given the patient.

Treatment. Treatment depends upon diagnosis; therefore the first step in the care of the woman whose pregnancy is suspected of being complicated by nephritis consists of an exhaustive attempt to establish the diagnosis or to render one of "toxemia of pregnancy." The patient should be immediately hospitalized and put to bed. A careful history and physical examination, including study of the eyegrounds by a competent person, is done. Such laboratory aids as are available, including renal function tests and blood chemistry should be utilized. The blood pressure should be determined at least once daily and the urine examined for albumin as often.

During this period of study the patient is placed on a diet relatively low in protein (about 40 grams per day) and poor in salt (a moderate amount used in cooking but no free salt). The bowels are kept open with saline laxatives and if edema is present their daily use is advisable. There is considerable disagreement as to the value of limiting the fluid intake but in the author's experience it is rarely to be advocated.

Generally speaking, the diagnosis of chronic nephritis should be considered by the conscientious obstetrician as an indication for termination of the pregnancy. The situation should be clearly explained to the patient and her family and the dangers of attempting to carry the pregnancy to term emphasized. Furthermore, the relatively poor prognosis for the child should be pointed out. If following such consultation with those interested it is desired that the pregnancy continue, the patient must be followed closely, with rigid supervision of her activities and diet, and careful regulation

of her bowels. The amount of activity which may be tolerated will depend upon the condition of the individual patient and the severity of the accompanying cardiac symptoms. In general, however, the quieter the woman may be kept the better off she will be. The efficacy of limiting the protein and salt in the diet is a matter of some question at the present time, but it is the author's opinion that such limitation is justified by clinical results. The interests of both mother and child are best served by interruption of the pregnancy as soon as it can be determined fairly definitely that the child is viable.

If after explanation it is requested that the pregnancy be terminated, this should be done by whatever means seem most conservative. Therapeutic abortion will be indicated in the early months and later the induction of labor or even occasionally cesarean section for the sake of the child will be necessary. The problem as to type of delivery is often complicated by a desire to sterilize the patient. Naturally one is loath to expose the already ill woman to the risk of a laparotomy but the prevention of future pregnancies is imperative. Often lack of cooperation or intelligence will render contraception unsuccessful and immediate sterilization by hysterectomy or tubal ligation will then best serve the patient's interests.

If a definite differential diagnosis between "nephritis" and "toxemia" cannot be made the patient should be carried through pregnancy as outlined. Every woman who has evidenced hypertension or albuminuria at any time during gestation and in whom the basis for the condition is not clear should be carefully and repeatedly observed after delivery. It is our opinion that such patients should not contemplate another pregnancy for two years but should be given contraceptive advice if necessary. The majority will sooner or later return to normal, in which instance permission for future carefully supervised childbearing may be given. However, in about one-third hypertension or albuminuria will persist and after a time the diagnosis (usually chronic vascular disease) will become definite.

CONCLUSIONS

It is obvious that what has been said represents a radical change from the teaching of a few years ago. However, it is our definite feeling that the problem of chronic nephritis complicating pregnancy cannot be treated too seriously and that only by considering every pregnant woman who manifests hypertension or albuminuria as a potential case of nephritis may many obstetric tragedies be avoided and the patient with chronic vascular disease be offered a longer expectancy of life.

DIAGNOSIS AND TREATMENT OF ABORTION

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THE diagnosis and treatment of spontaneous and induced abortion, are considered in this discussion but the indications for, or the methods concerned in the performance of abortion as a therapeutic measure are not included. All interruptions of pregnancy prior to the period of fetal viability are scientifically designated as abortions. Indeed the principal reason for the substitution of the term "miscarriage" depends upon the fact that the word abortion suggests to the layman a criminal procedure. While tactfulness may be served best by continuing the use of "miscarriage" when addressing certain types of patients, there seems no need to retain this term in medical nomenclature. It is preferable to speak of interruptions of pregnancy prior to the twelfth week as early abortions and of interruptions which occur from the twelfth week to the period of viability as late abortions.

The causes of abortion are discussed extensively in obstetrical texts and therefore will only be mentioned here. In the earliest months of gestation the expulsion of the product of conception is generally preceded by the death of the fetus. This may depend upon a defective germ plasm which in turn may originate in the germ cells of either parent or of both, upon a notable lowering of the temperature surrounding the fetus or upon a reduction in the supply of its oxygen. In other instances as pregnancy advances, pathologic changes may occur which result in a torsion of the cord, an excessive or scanty secretion of amniotic fluid or the development of a hydatidiform mole. Somewhat later fetal death may result from endarteritis of the vessels of the chorionic villi or from the premature separation of a placenta implanted normally in the cavity of the uterus or abnormally in the region of the internal os. Acute infectious diseases affecting the mother such as pneumonia and influenza, tend to bring about abortion and certain poisons such as mercury, arsenic and phosphorus, lead to a similar outcome.

Imperfections or anomalies in the development of the uterus predispose to anomalies in placental implantation and in the later development of this organ. On the other hand displacements of the uterus such as retroversion and retroflexion are now regarded as of less significance in the causation of abortion than was formerly believed.

Hyperplasia of the endometrium and a polypoid formation of the decidua both predispose to abortion as do also the decidual changes associated with the presence of myomata. Whether the evidences of an endometritis are of great significance is open to question for such an infection may have occurred subsequent to the inauguration of the abortion.

Although the lack of vitamin E has been shown experimentally to give rise to abortion, this factor probably plays a role only in those patients whose diet is limited in quantity and variety; and while derangements of the endocrine glands, notably the corpus luteum, may predispose to human abortion, too little is known at the present time to justify a definite statement on this point.

Abortion is sometimes attributed by the patient to trauma or violence but unless there is evidence that a blow has been applied directly to the uterus it is likely that some predisposing cause was already present. The degree of uterine irritability varies in different individuals and in those

in whom it is excessive, abortion may result even from coitus or from the usual pelvic examination. On the other hand the early pregnant uterus is often notably resistant to trauma as is shown by the history of one patient whose pregnancy progressed to term in spite of the fact that a curettage employed to effect an abortion resulted in the formation of a pelvic abscess which necessitated surgical drainage.

In addition to the causes which have been mentioned the premature death and expulsion of the ovum may depend upon a lowered vitality of the spermatozoa due to an acute toxemia induced by alcohol or to systemic poisons such as lead, phosphorus or arsenic.

The symptoms of abortion usually are slight or moderately profuse bleeding associated with cramp-like pains which are located in the lower back and abdomen and which may eventually become rhythmic in character. Vaginal examination of a patient who presents these symptoms generally discloses a softened cervix, perhaps slightly dilated, and a uterus enlarged to the size of a one to three months pregnancy. Such symptoms and physical findings with a history of amenorrhea usually leave no doubt as to the correctness of the diagnosis.

Nevertheless it is well to call attention to certain lesions which may be associated with uterine bleeding but which must be differentiated from uterine abortion. For example the problem of differential diagnosis may arise in those patients who harbor a tubal pregnancy and in whom uterine bleeding is associated with the death of the extra-uterine fetus. In such patients the amenorrhea will generally be found to be of shorter duration than in those in whom a uterine pregnancy exists. The uterus is softened and slightly enlarged and a sensitive, sausage shaped tube may be palpable. A biologic test according to the method of Friedman or of Aschheim-Zondek is sometimes of value. If positive, the test indicates that living chorionic cells are still in contact with the maternal tissues, but the result of the test is of no value respecting the location of the pregnancy. The solution of the latter problem rests primarily upon the skill and judgment of the examiner in determining the existence, and in interpreting the character, of any tubal mass adjacent to the uterus. A study of the uterine discharge may occasionally yield helpful information. When it is the result of a threatened uterine abortion, the blood loss is usually more profuse and bright red, and clots may be present. On the contrary, when associated with an unruptured tubal pregnancy the uterine discharge is generally brown and scanty. It should be emphasized that, in those patients in whom the possibility of an unruptured tubal pregnancy outweighs that of a threatened uterine abortion, vaginal examination should be employed with the greatest care. This point is of real significance since cases are on record in which unskillfully conducted vaginal manipulations have caused the rupture of a thinned out tube wall with fatal intraperitoneal hemorrhage.

Questions respecting the cause of the symptom arise not infrequently in patients with bleeding who present a uterus softened and symmetrically enlarged to the size of a three months pregnancy. The examiner may be uncertain from the pelvic findings whether the symptom depends upon a threatened abortion or upon the presence of a degenerating submucous or intramural myoma. Under such circumstances a careful study of the patient's menstrual history is indicated to determine whether there has been a recurring menorrhagia as is likely in association with myomata. The result of one of the biologic tests of pregnancy may be helpful. A positive reaction proves the existence of pregnancy, although a negative reaction does not rule out a possible missed abortion. If the physical examination and the result of the laboratory test are inconclusive, and there is no urgent indication for interference, further observation of the patient is generally indicated in order that the attendant may determine at a subsequent

examination whether the pelvic mass has increased in size as would be characteristic of a developing pregnancy, or shows no notable increase in growth.

Occasionally, as a result of the physiologically increased vascularization of the pelvic organs active bleeding may originate in a cervical adenoma or polyp which projects from the external os. This symptom may lead to the diagnosis of threatened abortion and possibly to the artificial termination of the pregnancy; but such an error in diagnosis and treatment should be excluded if the patient's history is studied and the cervix is carefully inspected with a speculum.

Patients who have introduced corrosive chemicals into the vagina in an attempted induction of abortion may present themselves with a history of genital hemorrhage which upon inspection is found to be relatively profuse. At first sight such bleeding may be interpreted as uterine in origin. However, upon further examination the hemorrhage may be found to originate not in the uterus, but in an erosion of the vaginal mucosa, and of the underlying blood vessels. We have seen several patients with hemorrhage of this character which was caused by tablets of potassium permanganate. The lesions were so extensive that the placing of sutures was necessary to control the bleeding.

As was stated earlier, the history of amenorrhea, the character of the uterine bleeding, the cramp-like pains and the pelvic findings leave no doubt in the majority of cases, respecting the correctness of the diagnosis of a threatened abortion. Under such circumstances the patient should be put to bed and a sedative such as morphia sulphate, grain ¼, administered and, if necessary, repeated every four hours. In certain patients the contractions and bleeding will lessen and finally cease; there is no recurrence of the symptoms, and following a rest in bed of at least a week the patient is allowed to be up and about, gradually to assume her usual activities.

In other patients the therapeutic measures employed fail to control the cramp-like pains or the uterine bleeding. These symptoms increase with a further dilatation of the cervix and the abortion then becomes imminent. However, even though this stage in the process of expulsion is reached, it is still possible that, with bed rest and sedatives, the uterine activity will cease and that the pregnancy will progress. On the other hand if the dilatation of the cervix continues in association with rhythmic contractions, increased bleeding, and a rupture of the membranes, the abortion becomes inevitable and the whole or a part of the product of conception may be expelled spontaneously from the uterus.

In the latter event it is important to examine the tissues which are cast off in order to determine whether the abortion is or is not complete. When abortion occurs late in pregnancy identification offers little difficulty for the fetus, even though mummified or macerated, and the placenta, are readily recognized. However, since the majority of abortions occur during the first three months of gestation, the examiner must be familiar with the appearance of structures cast off from the uterus during this earlier period. In certain instances the ovum together with a complete decidual cast of the uterus is expelled. Such a cast is identified as an elongated somewhat triangular structure which at each angle of its base exhibits openings corresponding to the position of the lumena of the tubes, and at its narrower end an opening corresponding to the position of the internal os. If the decidual cast is carefully slit, the ovum, represented by a small cystic structure, may be found attached at one point of the wall. More commonly the ovum at this early period is expelled as a vesicular structure surrounded by the decidua capsularis, or the decidua may be torn through and the ovum appear as a small, thin walled vesicle. Again, the ovum may be represented by a somewhat rounded, reddish structure with a surface which is shaggy and to which are

attached bits of clotted blood. Such a specimen if sectioned will show at one segment of its circumference a thickened portion which represents the early placenta; the remaining thinner portion consists of the amnion, the degenerating villi of the chorion laeve, and the remnants of the decidua capsularis. If the amniotic cavity is opened a small tag of tissue may be seen at the embryonic site. Except when the decidua is expelled as a cast it remains in situ to degenerate and to be cast off in the lochial discharge.

In cases in which the ovum has succumbed early in pregnancy and has been retained in the uterus, blood may gradually surround it and undergo coagulation. The resulting formation is designated a blood or carneous mole, and when expelled from the uterus somewhat resembles a mass of coagulated blood. If such a mass is sectioned there usually is found in its centre the smooth walled amniotic cavity. In other structures which are designated as hematoma moles, the amniotic cavity is almost obliterated and its walls are made irregular by polypoid projections due to the presence of hematomata beneath the fetal membranes.

So far we have considered threatened abortions which have yielded to treatment and those which have become inevitable, and in this connection we have noted certain problems of differential diagnoses and have mentioned some of the pathological changes which aborted ova present. We turn now to the treatment of cases of threatened abortion in which slight bleeding continues despite rest and medication. Generally in such circumstances a conservative course is advised provided the loss of blood does not exceed that of the individual's menstrual flow. It is our feeling nevertheless, that many of these patients are treated too conservatively and that too prolonged expectant procedures are an attempt to defeat the purpose of Nature. This point of view is based on the knowledge that many aborted ova show pathological changes of varying degree of which some are interpreted as the forerunners of monsters. Therefore it seems inadvisable to prolong such a patient's stay in bed beyond seven to ten days. At the expiration of this period she is allowed about her room in order to determine whether such activity will so increase the degree of bleeding that a completion of the abortion is clearly indicated. If this occurs we may proceed to empty the uterus by one of the methods to be described. If the patient's activity fails to cause an increase in the loss of blood we delay any active interference for an interval of two or three weeks in order to determine whether, in spite of continued slight discharge, the uterus has increased in size or remained stationary in its development. In the former circumstances a conservative course is followed. On the other hand if examination after an interval of three weeks convinces us that there is no increase in the size of the uterus and if these findings are correlated with a negative Aschheim-Zondek reaction we assume that the fetus is dead and then proceed to empty the uterus by one of the following procedures.

If the cervix is softened and the canal sufficiently dilated to admit one or two fingers the patient is taken to the operating room and a general or local anesthetic is administered. The perineum is surgically prepared and the bladder emptied by catheterization. Following this preparation the hand anointed with sterile oil is introduced into the vagina and the position of the uterus determined. One, or better, two fingers are then passed into the cavity of the uterus. The fundus is grasped through the abdominal wall by the opposite hand and pressure is made against the intrauterine fingers. The latter gently detach the placenta from the uterine wall and remove the tissue from the uterine cavity. We do not employ a curette for this purpose as this increases the danger of perforation of the uterine wall, particularly if the uterus is sharply anteflexed or retroverted. Moreover, the curette is a less efficient means than the sensitive fingers of

determining conditions within the uterine cavity. However, we may employ ovum forceps to remove portions of placental tissue which have already been detached by the fingers. We see no objection to the use of this instrument provided it is not introduced forcibly into the uterine cavity and provided the outline of the cavity is gently palpated before any manipulations are undertaken. On the other hand, we do not approve of an attempt to detach placental tissue with the ovum forceps because of the danger of perforating the wall of the uterus. In connection with the digital palpation of the uterine cavity it should be pointed out that the site of implantation forms a somewhat irregularly roughened area which must be distinguished from fragments of placental tissue which still may remain attached to the uterus.

In the majority of patients the uterus contracts satisfactorily following the removal of the products of conception and there is but little bleeding. Only occasionally have we found the use of a pack indicated. If such a measure for the control of bleeding is employed, the gauze, introduced with great care, should be carried to the greatest depth of the uterus and its entire cavity packed from the fundus to the internal os. Otherwise bleeding may occur into any free space left above the pack. In patients in whom the use of the pack is not necessary, but in whom the uterus fails to contract satisfactorily, 0.5 c.c. of pitocin may be administered hypodermically to be followed by ergotole in half dram doses every four hours until eight doses are taken.

In patients in the first months of pregnancy, in whom the cervix is firm and undilated and the termination of the abortion is not urgent a more conservative course is followed. The perineum having been surgically prepared and the bladder catheterized, the cervix is then exposed with a speculum. The tip of a gauze roll is introduced into the cervix and the canal and the vagina are firmly packed. The gauze is allowed to remain in situ for twenty-four hours when it is removed. In some patients following the withdrawal of the pack, the product of conception will be found in the vaginal vault. In others although the ovum has not yet been expelled, the cervix will be found sufficiently softened and dilated to permit the introduction of the finger into the uterine cavity. If, on the other hand, the canal will not yet admit a finger, the required dilatation can usually be attained by the judicious use of the Hegar or Goodell dilators. The cavity of the uterus is then explored and emptied by the detailed procedure. When the pregnancy has passed beyond the fourth month we discard the gauze pack as a means of cervical dilatation. If the cervical canal is sufficiently softened and dilatation is indicated we then employ graduated Hegar dilators, or introduce a medium sized Voorhees bag.

In patients in whom the emptying of the uterus is urgent and who present a firm undilated cervix we employ vaginal hysterotomy which permits digital access to the uterine cavity. Such a procedure is safer and more rapid than the dilatation of the rigid cervix by means of metal dilators which may cause extensive lacerations and cervical hemorrhage and predispose to subsequent infection. The reader is referred to the obstetrical texts for the technique of the vaginal hysterotomy. It may be noted however that the procedure is facilitated by the use of a speculum sufficiently large to hold the bladder well upward and thus clearly to expose the line of incision in the cervix, and by confining the incision of the cervix to the midline in order to avoid excessive bleeding.

In the foregoing paragraphs we have touched upon problems which may arise in patients who are seen in the earlier stages of abortion. It remains to consider those cases in which the fetus already has been expelled from the uterus but in which the whole or portions of the placenta have been retained. Such incomplete abortions

are most commonly seen when the pregnancy has progressed beyond the third month. Patients with this complication may present a normal temperature range and normal periuterine findings, or definite indications of an intrauterine infection. In some instances the loss of blood previous to admission may have been so excessive that transfusion is necessary before any operative procedure can be safely undertaken.

Excepting those individuals in whom an immediate evacuation of the uterus is indicated because of active bleeding, we prefer to observe all patients with incomplete abortion for at least twenty-four hours in order to determine whether infection is present. If at the end of this period there is no elevation of temperature and pelvic examination fails to reveal induration of the parametrial or adnexal regions, the patient is anesthetized, the perineum appropriately prepared for operation and the bladder emptied by catheterization. Usually the cervix will be found sufficiently dilated to admit one or two fingers. In patients seen sometime after the onset of the abortion and in whom the cervix may be less dilated, the necessary enlargement of the canal can generally be brought about by the use of graduated Hegar dilators. The retained structures are then removed by the same method employed in the completion of a threatened abortion. In patients who enter the wards with an elevation of temperature and other signs of intrauterine infection we defer any intrauterine manipulation until the temperature has reached the normal level and remained there for five or six days. Because of the great danger of opening up avenues for a further extension of the existing infection, we invade the cavity of the frankly infected uterus for two reasons only. We remove with an ovum forceps detached placental tissue which protrudes through the external os, and we employ a gentle digital curettage in patients with alarming bleeding. With these exceptions we rely upon supportive measures including blood transfusion in all patients in whom the uterus is infected.

Patients with missed abortion usually give a history of amenorrhea which later is associated with enlargement of the breasts and other subjective symptoms of pregnancy. Subsequently there occur transitory cramp-like pains in the back and slight uterine bleeding; but in spite of these symptoms the patient believes that the pregnancy is progressing normally. Sometime later however, pelvic examination reveals a uterus which, when the duration of the amenorrhea is considered, is smaller and less resilient than it should be. Under such circumstances the examiner is led to believe that the uterus harbors a dead fetus. It is unwise however to venture this diagnosis upon the basis of a single examination. Consequently the patient should be reexamined at the end of a four to six weeks interval in order that the findings at this time may be compared with those previously recorded. If during this interval the uterus has not increased in size, and other signs of pregnancy are absent, and if one of the biologic tests of pregnancy gives a negative reaction the diagnosis of a missed abortion may reasonably be made.

If the patient is afebrile and mentally at rest and there is neither malaise, headache nor loss of weight, no urgent indication for the emptying of the uterus exists and an expectant course may be followed in the hope that the product of conception will be expelled spontaneously. Should this not occur after a period of a month has elapsed, the uterine cavity should be explored and its content removed. If the cervix is sufficiently soft, dilatation may be accomplished by the use of Goodell's or Hegar's dilators. In patients in whom the cervix is firm and undilated, vaginal hysterotomy should be employed.

Habitual abortion refers to the expulsion of a previable fetus in recurring pregnancies. The definite cause of this anomaly is as yet, unknown, and although experimental work on animals would indicate that a deficiency in the hormone of the

corpus luteum may be a contributing factor in the early termination of human pregnancy, no definite statement with respect to this point can be made at present.

Prophylactic therapeutic measures are similarly applicable to patients who have aborted once or repeatedly. A general physical examination is indicated in both husband and wife to rule out any organic disability in either. The spermatozoa should be studied in order to determine whether they are normal, and a pelvic examination should be made to discover anomalies in development or in position of the uterus or of its associated structures. It is wise to advise that the patient refrain from becoming pregnant for an interval of two years. In the meantime the diet should be abundant and varied and rich in vitamin and calcium content.

If pregnancy occurs subsequently the patient should rest during the first four months, particularly upon those days when menstruation would normally occur, and at no time should she indulge in violent exercise. Intercourse should be interdicted during the first four months of gestation and in certain cases for an even longer period. In patients who have had repeated abortions and whose desire for a living child is great, success in this respect may be attained only by remaining in bed throughout the major part of the pregnancy.

SUMMARY

The present paper discusses the diagnosis and treatment of spontaneous and induced abortion. The causes of this complication are mentioned; certain problems of differential diagnosis are considered; and the most common pathological changes found in aborted ova are briefly described. The methods of treatment which constitute the body of the paper are based upon an extended practical experience in our clinic.

ECTOPIC GESTATION

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BY definition, ectopic gestation is the nidation and development of the fertilized ovum in any location outside of the cavity of the uterus.

Its incidence is difficult to determine largely because it is one of those anomalous conditions which appear to fall indiscriminately into the field of, and be claimed by, the obstetrician, the gynecologist and the general surgeon alike.

The incidence in our clinic is approximately only 1:1000, but Schumann by a comparison of the admissions to all the hospitals in Philadelphia and the gross figures for births registered in that city, after arbitrary correction of these figures, computes the incidence at about 1:300.

Inasmuch as the fertilization of the ovum occurs invariably before it enters the uterine cavity, its nidation and development outside of that cavity depend on many conditions which tend to interrupt or impede the progress of the ovum toward the uterus after it is fertilized.

Such impedance usually occurs in the Fallopian tube and depends upon a variety of factors, most important of which is prior inflammatory involvement of the oviduct. The manner in which such inflammatory involvement of the tube impedes the passage of the ovum may be either by general narrowing of the lumen of the tube; by constriction of that lumen by adhesions external to the tube; or, perhaps most importantly, by the denudation of the ciliated lining of the tube, which normally assists the ovum in its progress toward the uterus; or by inflammatory agglutination of the complexly arranged folds of the epithelial lining of the tube in such manner as to form crypts or culs-de-sac, into one of which the ovum drops, is caught, and can make no further progress.

The occurrence of endometrial transplantation in the tube or elsewhere outside the cavity of the uterus may also be considered as a possible etiological factor in the nidation of the ovum in such locations.

The impedance may occur at various points in the course of the lumen of the tube, and wherever it does occur the ovum is arrested, nidation takes place and development proceeds. This constitutes primary ectopic gestation. Its location within the tube is distinguished as being respectively in the ampullar, the isthmic or interstitial portions thereof.

Primary ectopic gestation may also occur in the ovary. This is relatively rare, and the mechanism of its occurrence is not well understood. For a long time its possibility was denied but pathologists now generally believe that it does occur. The criteria for its pathological acceptance are very strict. They are those laid down by Spiegelberg, viz:

1. The gestation sac must occupy the anatomical position of the ovary.
2. The tube in relation to the effected ovary must be intact.
3. The sac must be attached to the uterus by the ovarian ligament.
4. Ovarian tissue must be demonstrated in the wall of the sac.

In our experience we have seen only one case which we thought was a possible primary ovarian pregnancy, but we were not absolutely sure that one of the criteria for a positive diagnosis had been fulfilled.

Primary abdominal gestation, that is, ectopic gestation in which the original nidation of the ovum occurs in some part of

the free peritoneal cavity, is now conceded by most authors to occur, but is by far the rarest form and its criteria are even more strict than for the ovarian variety. They are:

1. The tubes, ovaries and broad ligament must appear wholly normal except at the site of implantation.

2. The fimbriated extremities of neither tube must have penetrated between the layers of the broad ligament.

3. Neither tube must be ruptured between the layers of the broad ligament.

4. There must be no evidence of escape of the ovum from the uterine cavity.

Primary nidation and development having occurred in the locations indicated, a variety of sequences may occur. The relatively limited distensibility of the tube or ovary and the absence in them of any decidua makes full development of the pregnancy in its primary location almost or quite impossible. Because of this same lack of a normal decidua in the tube or ovary, pathological hemorrhage of some degree invariably accompanies the growth of the gestation product. This hemorrhage arises from parasitic invasion of the muscular wall of the tube or the parenchyma of the ovary, neither of which is protected by a specially functioning decidua. So erosion of the blood supply of these tissues is inevitable, and a greater or less degree of hemorrhage results.

Fig. 1. Early tubal pregnancy.

Fig. 2. Tubal pregnancy, about two and one-half months.

If this occur early, the ovum may be deprived of its sustenance, in which case it dies and is resorbed. If the development proceeds further the sac sooner or later becomes surrounded by hemorrhagic exudation. If it is located in the ampulla of the tube, the accumulated blood around and behind the sac commonly forces it out of the ampullar end of the tube, thus constituting a tubal abortion. If located in the more proximal portions of the tube, however, dislodgement through the ampullar extremity does not usually take place, but the hemorrhagic and destructive invasion of the tube wall itself eventually penetrates that structure. Hemorrhage into the free peritoneal cavity results and the ovum may

be extruded through the rupture. Much the same mechanism may occur in primary ovarian implantation.

the dislocation of the ovum commonly gravitates into the cul-de-sac and becomes more or less organized, constituting pelvic

Fig. 3. Advanced ectopic pregnancy removed intact, and probably primary ovarian. Because of the extreme attenuation of the sac, histological demonstration of ovarian tissue therein was impossible. In all other ways it fulfilled the criteria for ovarian pregnancy. The probability of such identity was confirmed by Prof. James Ewing of New York.

In any of the several events described, severe intra-abdominal hemorrhage accompanies the dislocation of the ovum and surgical intervention is usually forced at this time and the condition is terminated. Often, however, this is not the case, and the ovum remains viable after its dislocation from its original site of nidation. It then continues to develop, constituting thenceforth a secondary ectopic gestation. Such secondary development may occur any place within the pelvic or abdominal cavities or between the folds of the broad ligament. We thus see types designated as intraligamentous, tuboovarian, and abdominal.

Such secondary ectopic gestations may proceed to various stages of development up to full term. If death of the ovum occurs, it may remain indefinitely, going on to various types of caseous, fatty or calcified degeneration. The blood accompanying hematocele. Unless massive or infected, such hematoceles may escape observation and be eventually absorbed.

If the ovum lives to an advanced period of gestational development, its delivery by abdominal section is the only means of removal. Such children are occasionally born alive but frequently present serious abnormalities of development. Therefore, the living birth of healthy children following ectopic gestation is relatively rare and the abdominal variety is essentially the only one that offers a chance of successful termination. I have myself seen only 3 cases of approximately full time ectopic gestation, 2 of which resulted in the birth of living children, but only one of these children survived and was wholly normal in its development.

The great variety of pathological status and course of ectopic gestation necessarily connotes a most protean symptomalogy.

The condition therefore constitutes one of the most baffling diagnostic problems presented to the obstetrician or gynecologist vaginal bleeding and shock of some degree. It will be observed that all of these are symptoms of disturbance of the pregnancy.

Fig. 4. Old ruptured tubal pregnancy.

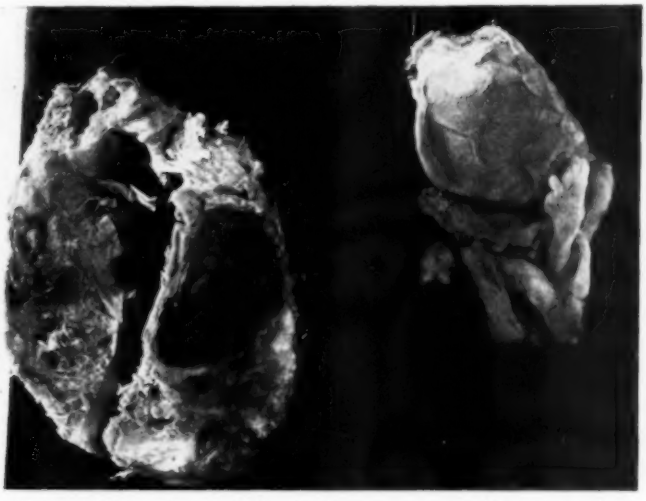

Fig. 5. Secondary abdominal pregnancy with mummified fetus following rupture of tube.

but a further factor adds to this difficulty. The uterus itself develops to a degree which during the early weeks of gestation parallels that of normal intrauterine pregnancy and also presents a decidual development comparable to that of normal pregnancy.

The behavior of the intrauterine decidua furthermore parallels the events taking place in the ectopic pregnancy. Thus dislocation and death of the ovum in ectopic pregnancy is invariably attended by hemorrhage from the intrauterine decidua and portions or complete casts of that decidua may be thrown off. These, to uncritical inspection, do not differ from the discharge accompanying intrauterine abortion.

In the diagnosis, history is most significant, especially that of prior periods of sterility, a definite or suggestive history of prior inflammatory disease, minor discrepancies in the behavior of the case, particularly in regard to spotting or pain not consistent with the usual history of normal intrauterine pregnancy. However, it is to be noted that there is much irregularity in the history given and a frequent failure to conform to classical forms. The most important and constant but by no means invariable symptoms are pain, Numerous authorities are agreed that vaginal bleeding does not occur until death or separation of the ovum inaugurates certain hormonal effects on the intrauterine decidua. The course of ectopic pregnancy prior to some disturbance of, and hemorrhage about, the ovum, is precisely similar to that of normal pregnancy, and its recognition is probably not possible except by accident.

When disturbance does occur, there is pain. This is dull and diffuse if merely due to increased tension about the sac, or to slow abortion, with minimal leakage of blood into the general peritoneal cavity. It is agonizingly sharp if hemorrhage about the sac is rapid, proceeding to explosive rupture, or extrusion of the conception product and profuse bleeding into the abdomen.

Because some disturbance of the ovum, sometimes with death thereof, occasionally precedes its final complete dislocation, vaginal bleeding may precede the pain which signalizes the more serious turn of events. Such bleeding is rarely profuse, and bears no relationship whatever to the general seriousness of the situation. The blood is generally dark and does not tend to clot.

Usually, however, the course of events from initial disturbance to calamitous culmination is more rapid, and here the pain is more or less concomitant with the uterine bleeding, or may precede it.

Shock depends both on the loss of blood due to internal bleeding and to the trauma of the visceral rupture. It is thus peculiarly characteristic of ruptured ectopic gestation. It is not always, however, of such severe degree as to be easily evident. Even in such cases, it is significant if the history elicits even mild indications of shock, as transient weakness or syncope.

Physical examination is, of course, important, but the findings are not necessarily typical and are frequently most confusing. Moreover, examination is not always satisfactory, because it must be constantly borne in mind that any but the gentlest manipulation may result in the rupture of the already tense sac, and the precipitation of a most serious clinical condition dependent on internal hemorrhage.

However, the ectopic mass may be made out by gentle palpation before actual rupture, but not before hemorrhage about the sac has altered the consistency of the tube. When demonstrated there will be marked tenderness over the mass. The ordinary signs of early pregnancy referable to the external genitalia, cervix and corpus uteri, will more or less conform to those of intrauterine pregnancy and the history of the duration of pregnancy.

After rupture, in addition to the mass lateral to the uterus, there may be palpated by vagina, a doughy or crepitant mass in the cul-de-sac, and exquisite tenderness. Lower abdominal tenderness and rigidity will express the peritoneal irritation caused by free blood in that cavity.

The pulse rate and the temperature are not of great differential value; the former will vary with the degree of shock present, and the latter, though rarely high, may fluctuate within a range common to other conditions.

"Cullen's sign," a bluish-black discoloration about the umbilicus, is inconstant, and has no negative value.

Pathological examination of the intrauterine decidua may be suggestive but is not necessarily conclusive. Such decidual fragments do not contain chorionic elements, inasmuch as the ovum from which the chorionic elements arise never entered the uterine cavity, but the absence of chorionic elements is not always conclusive, because not infrequently the fragments obtained from intrauterine abortion may be so degenerated as to make the recognition of chorionic elements therein impossible.

The blood count is not always of much help. The red count is not much affected except by severe rapid hemorrhage. The white count shows only slight increase with small hemorrhage. If there is a series of several small hemorrhages manifested by recurrent attacks of pain, the white count may fluctuate with the onset and subsidence of these repeated episodes. While it is true that massive hemorrhage results in very high leucocytosis and polynucleosis, the evident effect of such catastrophe on the patient's general condition hardly requires the confirmation of either low red or high white count.

Similarly, blood pressure readings are non-characteristic except as an expression of the degree of shock. Even in shock it must not be too greatly relied upon as an index thereof, for marked lowering of blood pressure may occasionally not occur until the patient is in most serious danger.

Hormonal tests for pregnancy are of qualified usefulness only. If positive, they do not indicate whether the pregnancy is intra- or extra-uterine, intact or ruptured. If negative, they do not necessarily rule out ectopic, as the later sequels of an ectopic may be present after the death of all embryonal elements.

Of course, the constitutional reaction due to massive intra-abdominal hemorrhage, superimposed on a suggestive history and the physical findings will in many

cases establish the diagnosis and furnish adequate indication for surgical interference. Such concurrence of history, symptomatology, physical findings and hemorrhagic shock may constitute so definite a picture that "he who runs may read." But we have seen that the bleeding accompanying the termination of ectopic gestation does not always produce definite shock, and diagnosis then demands all the resource and acumen which the examiner can bring to his aid.

Fig. 6. Unruptured fetal sac in ruptured tubal pregnancy.

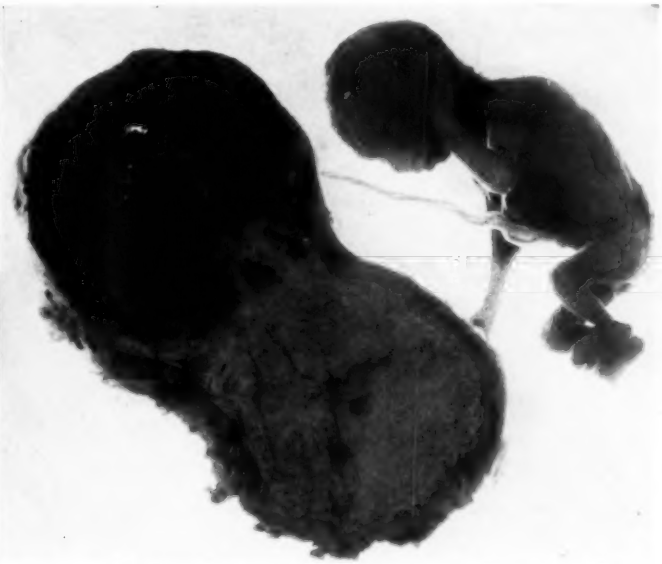

Fig. 7. Ruptured interstitial pregnancy, four months, necessitating ablation of uterus.

Almost invariably the diagnosis of ectopic gestation constitutes a definite indication for surgical interference. Such interference is imperatively and urgently necessary when accompanied by severe internal hemorrhage. Surgical procedure usually calls for the removal of the gestation sac and the ablation of the organ or organs which are involved in the destructive effects which have accompanied its development. These sometimes involve the uterus itself, so as to make hysterectomy necessary (Fig. 7).

In connection with this urgent group of cases, it cannot be too strongly urged that the menace to the patient's life is the hemorrhagic shock itself. Therefore, treatment of shock by intravenous infusion of saline, glucose and whole blood must precede the institution of other operative procedure and must be continued after the source of bleeding is controlled, until the patient's condition is satisfactory enough to no longer need them. Ideally, this means good team work in promptly typing the patient's blood, obtaining donors, setting up the operating room for transfusing and laparotomizing the patient nearly simultaneously, starting transfusion, and then, assured that it is proceeding smoothly, rapidly opening the abdomen and securing the source of bleeding. While preparations for operation are going on, the patient should be placed in the Trendelenberg posture, external heat applied, morphine exhibited, and intravenous infusion started, without regard to the fear of increasing bleeding before its origin can be reached and controlled. But note that the scheme of management indicated here is not a plan of *waiting for the patient to react* before operating, but of operating in the best way *as soon as one can* and doing everything possible for the patient while preparing for the operation.

In the cases which have been described where very early tubal abortion or rupture of very early tubal pregnancies has oc-

curred without shock from internal hemorrhage, and the fetus has died, and irritation from the escape of blood and conception product into the abdominal cavity has subsided, surgery may occasionally be entirely eliminated.

Where tardy recognition of the condition has resulted in spontaneous control of bleeding, even after the escape of considerable quantities of blood into the peritoneal cavity and such blood has formed pelvic hematocele, and this mass has become infected, surgery is sometimes best postponed until subsidence of the acutely severe inflammatory invasion.

Of laparatomies done for the delivery of far advanced fetuses, little need be said. The surgical procedure depends upon the extent and location of the placentation accompanying such gestations. Rarely, the gestation sac and the placenta arise entirely from the tube, ovary and broad ligament in such a way as to be completely pedunculated, in which event their ablation is easily feasible. As a rule, however, the placentation is so broad and involves attachment to the serous surfaces of so many, or to such extent, of the abdominal viscera as to make attempts at removal of the whole organ exceedingly dangerous. Various expedients have been adopted to meet such situations. On one occasion we marsupialized the sac, following which the whole placenta eventually sloughed away through the abdominal wound. While some authorities still favor this method as safest, the more modern trend of practice is to evacuate the sac and forthwith close the abdominal cavity leaving the placenta in situ.

My former associate, Dr. Ware of the Medical College of Virginia, has, I think, brilliantly demonstrated this.

The choice of anesthesia is of considerable importance in the more serious group of cases. Relatively light narcosis will probably suffice, but the choice of agent will vary somewhat with the operator's experience and equipment. I would consider ether vapor, ethylene or cyclopropane as best.

CONCLUSIONS

Ectopic gestation presents an astonishingly varied pathology; a variation in history and symptomatology affording frequent and perplexing diagnostic problems; potentiality of sudden and gravest emergency; the necessity of constant guard and preparation to promptly handle those emergencies; occasional challenge to the utmost operative finesse; but in spite of all this, an opportunity for results satisfactory in almost as dramatic a degree as the frequent fulminance of its development.

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PRACTICAL ASPECTS OF STERILITY STUDIES*

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THE basis of successful treatment of human sterility is an accurate discovery of as many causes as possible in each given case. It is decidedly uncommon not to find a number of contributing factors in both the wife and the husband. Having found these, their treatment is usually simple and highly effective, while unsatisfactory results often depend upon how many of the total faults have been overlooked.

In order to make this paper as practical as possible, I propose to outline the minimum routine course of study to which every such couple should be subjected, with certain details of the medical team work advisable to arrange for this. Methods of treatment are usually so obvious when the faults have been diagnosed and tabulated, that these will require comparatively little discussion.

It is perhaps unfortunate that this work is somewhat highly specialized. The best results are obtained when at least a gynecologist and a urologist form a team for making these studies. The assistance of a pathologist, of an internist and of a roentgenologist is also helpful, but active cooperation between the gynecologist and the urologist is almost essential.

The treatment of cases of relative sterility will result in 20 to 50 or more per cent of pregnancies, this variation depending largely upon the degree of detailed and painstaking care with which these cases are studied, and then accordingly treated. It is also possible to correct many cases of absolute sterility by certain operative measures, accurate diagnosis being an essential basis for this, also.

It is apparent from the foregoing that both the wife and the husband must agree in advance to permit a complete study and physical examination, which will include a number of special features. Their joint responsibility must be explained with emphasis and the steps in the study should be outlined at the first consultation, because if they both do not agree to undergo these studies it is best to proceed no further. With a little tact the physician will usually be able to make the couple see the reasonableness of this stand and obtain their full cooperation.

RELATIVE AND ABSOLUTE STERILITY

There are two main types of sterility, namely, relative and absolute. The first of these is that in which pregnancy is not impossible but several factors have interfered with it, most of them usually of minor degree. The second, or absolute sterility, results from anatomic defects in either the female or the male or both, or from pathologic changes in their reproductive organs due to disease or injury. Many instances of both relative and absolute sterility are correctable.

STEPS IN STERILITY STUDIES

The histories of the wife and the husband should be taken with detailed reference to facts bearing on the sterility. Consequently it is advisable to have special blank forms for this purpose, both as a guide and for uniformity.

To quote from a previous paper,[1] the following items of history may be cited as important:

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It is important to know how long the couple has been married and how long contraceptives were used. A childless couple cannot reasonably

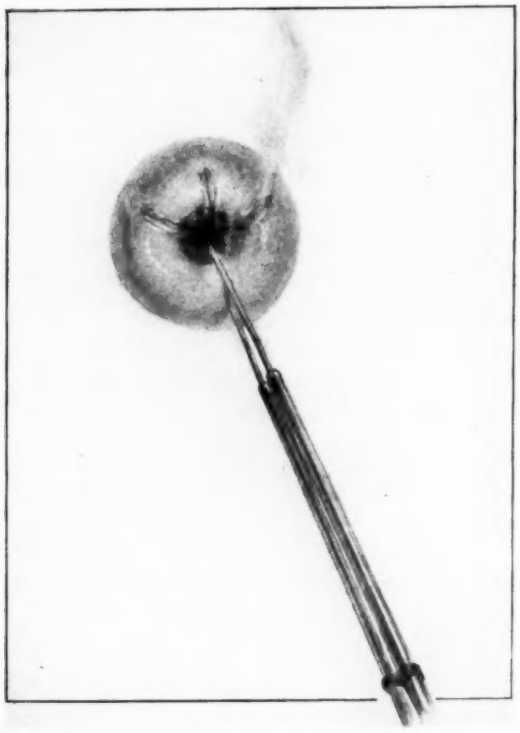

Fig. 1. Light, radial cauterization of cervix for endocervicitis.

be classed as sterile unless they have been endeavoring for at least one year to accomplish a pregnancy.

History of previous marriages of either wife or husband, and whether or not these were childless, is important, as is also a record of earlier pregnancies in any couple now having a so-called secondary sterility.

Without referring here to every detail of this special record form, it is clear that data concerning illnesses and operations on the wife are essential, while special information must be sought from the husband concerning venereal infections, and mumps with orchitis.

The occurrence of menstrual irregularity in the wife suggests ovarian dysfunction with possible disturbance in ovulation, to be tested for more accurately by hormone estimations and a premenstrual endometrial biopsy.

The general history of both must be obtained in respect to possible deficiency in proteins and various vitamins in the diet, the excessive use of alcohol, the frequency of coitus, the use of lubricants which may have an unsuspected contraceptive effect, and the matter of whether coitus takes place most often before and after the menstrual periods or during the more favorable intermenstrual "ovulation period."

Physical Examination of Wife and Husband. It is advisable for the gynecologist to direct this work and get it well under way, because he is usually the one first to be consulted. The taking of the history of both will have been done by him; he will naturally be expected to conduct the wife's examination.

Foci of infection must be sought and removed when found. All visible evidences of glandular disturbances should be noted, such as localized obesity and peculiarities of hair-growth. Frequently there will be an associated history of menstrual irregularities.

The gynecologist must make arrangements for both husband and wife to have a blood count, a urinalysis, blood pressure readings, and last, the important item of basal metabolism estimations.

Anemia and deficiency in thyroid activity are so frequently associated with lower than average blood pressure readings, that this latter finding should suggest such possibilities. Mild chronic nephritis may or may not have a concomitant increase in blood pressure, and either or both findings should suggest the possibility of focal infections.

Ovarian and pituitary functions in the female are closely interlocked with those of the thyroid and other ductless glands. The interrelated influence of these three glands on ovulation, menstruation and even pregnancy are so well known that they need not be recounted. It is true that there are fairly accurate tests for ovarian and pituitary activity (Frank,[2] Kurzrok[3]), but the finding of a low basal metabolic rate, especially when accompanied by clinical symptoms of hypothyroidism, is good presumptive evidence of derangements not only of the thyroid gland but also of these others mentioned. Fortunately, the administration of adequate amounts of thyroid substance will often correct the thyroid deficiency

and with this, that of the pituitary gland and the ovaries.

Quite consistently, much the same is true of the male. It is common to find deficient spermatogenesis in men with hypothyroidism, and the administration of full therapeutic doses of thyroid substance will usually act as a spermatogenetic stimulant.

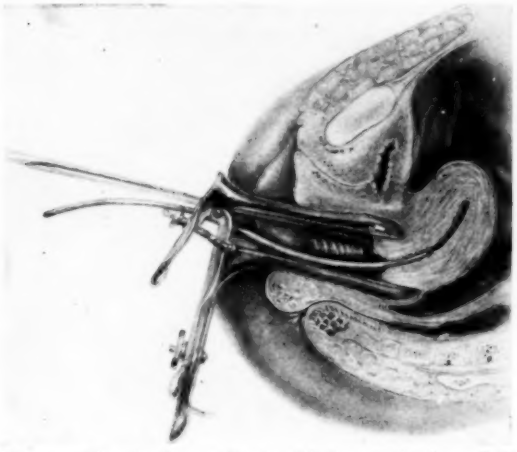

Fig. 2. Cervical canal should be probed and if stenotic, should be moderately dilated.

The Gynecologic Examination. Search should be made for genital anomalies or malformations, cervicitis, uterine displacements, tumors, and evidence of chronic pelvic inflammatory disease.

Of these it is probably true that simple cervicitis with endocervicitis is the most frequent cause of relative sterility. Each instance of this is accompanied by some degree of leucorrheal discharge and, more important still, by a thick tenacious plug of mucus in the cervical canal which so often effectively interferes with the upward passage of the spermatozoa.

Douches of alkaline or saline solutions are useless except as temporary measures, and treatment must be directed toward removing the cause. Cauterization of the infected area by light radial striping with a fine pointed actual cautery, or by conization with the electrosurgical cutting loop of Hyams,[4] are appropriate treatment. In many instances, frequently repeated moderate dilation of a stenotic cervix and aspiration of the mucus plug must be carried out for a time.

Uterine displacements may interfere with, but probably do not directly prevent conception. Deep retroflexion of the uterus causes chronic passive congestion of the cervix, and may thus produce sufficient cervicitis to cause temporary or even prolonged sterility. Pessary support after manual replacement is often sufficient to correct this difficulty, especially if infected areas around the external os are removed as described.

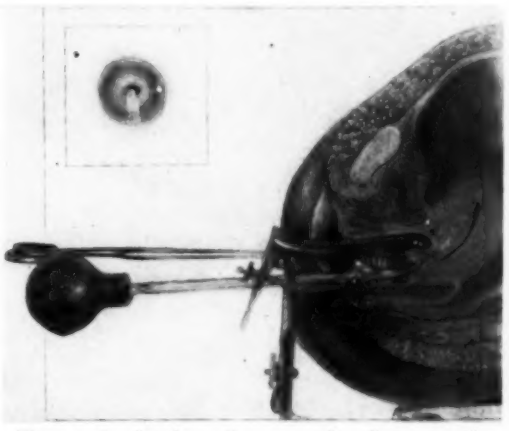

Fig. 3. Aspiration of mucus plug from cervix.

Tumors of the uterus may impede conception by mere mechanical action, or by making the endometrial bed unsuitable for nidation of a fertilized ovum. They should be removed. Tumors of the ovary are less of an obstacle but should likewise be removed when discovered.

The condition of the fallopian tubes must be determined, and the fact of their patency established. This is done by transuterine insufflation with carbon dioxide, appropriately termed the Rubin test.[5] Injection of an opaque medium for *x*-ray visualization has its place, but should no longer be considered as competing with the Rubin test, which has superseded it. *X*-ray studies should be limited to those cases in which obstruction of the tubes has been demonstrated by gaseous insufflation, and utilized only to locate the site and nature of this obstruction.

There should be no necessity to describe the Rubin test here. It is sufficient to say that the gas is passed into the uterus and

out through the tubes, if patent, at a slow rate, the resistance pressure being indicated by a mercury column, and the total amount

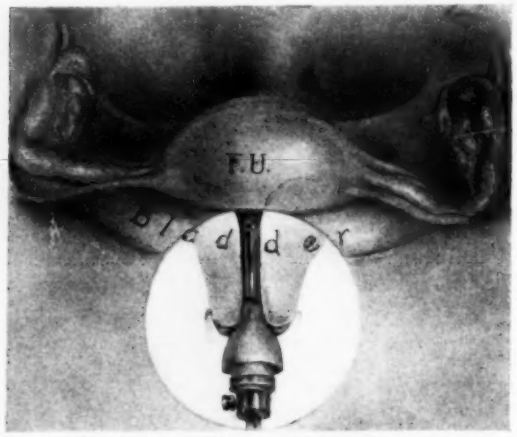

Fig. 4. Tubal insufflation (Rubin test). Carbon dioxide gas under measured pressure is passed through cannula inserted into cervical canal.

injected being measured by a water displacement meter. With normally patent tubes the gas should pass at a pressure of about 80 mm., and with obstructed tubes one should stop when the pressure reaches 210 to 220 mm. Between these two extremes, one may find instances of obstruction sufficient to cause the mercury to rise to 150 or 160 or more millimeters at which point there is a sudden release and the column drops to about 100 mm. or less. These are the cases in which the Rubin test often becomes an active therapeutic measure, in that it stretches and opens constricted and otherwise obstructed but not occluded tubes.

Two important points should always be recalled in making this test. The first of these is that it should be done, preferably, during the week or ten days following a menstrual period. Too soon after a period there will be a persistence of the endometrial congestion with obstructive interference to the passage of the gas. At the time mentioned, stretching and opening of the tubes shortly prior to the supposed time of ovulation offers the most favorable outlook for therapeutic effect resulting in pregnancy. Later than this, there is always the possibility that a pregnancy may have occurred and that the introduction of the sound may produce a miscarriage.

Evidence obtained by the Rubin test suggesting that the tubes are totally occluded or seriously obstructed warrants injection with an opaque medium followed by radiograms to locate the site of the obstruction. These are the patients with absolute sterility for whom plastic operations to restore the tubal patency may be indicated, depending upon the *x*-ray findings (Fig. 5). Tumors, either suspected or not, are often demonstrable by this means, as are septa and other congenital malformations of the uterus. Hyams[6] has suggested that five fractional injections of 2 c.c. each should be made with a series of *x*-ray pictures taken after each such injection. Such serial pictures showing the progressive filling of the uterus and tubes give much more information than a single, larger injection with only one or two pictures.

A new, viscid solution of iodomethane sulphonate (skiodan) with acacia[7] is preferred to the older iodized oils which were so often intensely irritating to the adnexa, due to the escape of free iodine.

The treatment of absolute sterility in the female by plastic operations on "clubbed" and stenotic tubes has been admirably described by Holden and Sovak.[8] Lack of space prevents any repetition of this here.

Special Examination of the Male. This is the work which can be done so efficiently by the urologist, as mentioned in the foregoing.

As in the female, evidences of congenital anomalies must be sought, the most important of these being epispadias, hypospadias and undescended testicles.

The prostate should be palpated, and especially when there are active foci of infection in the teeth or tonsils, this gland may be found to be soft and enlarged, the seat of a secondary low grade infection. A regular course of prostatic massage is especially effective in such instances.

The examination of the spermatic fluid may be done by the urologist, the gynecolo-

gist, or by a pathologist, but is a matter which I wish especially to emphasize. It is usually improperly or inadequately done.

There is not sufficient space here to give the details of this work, but these may be found in the references given.[1,8,9,10] It must

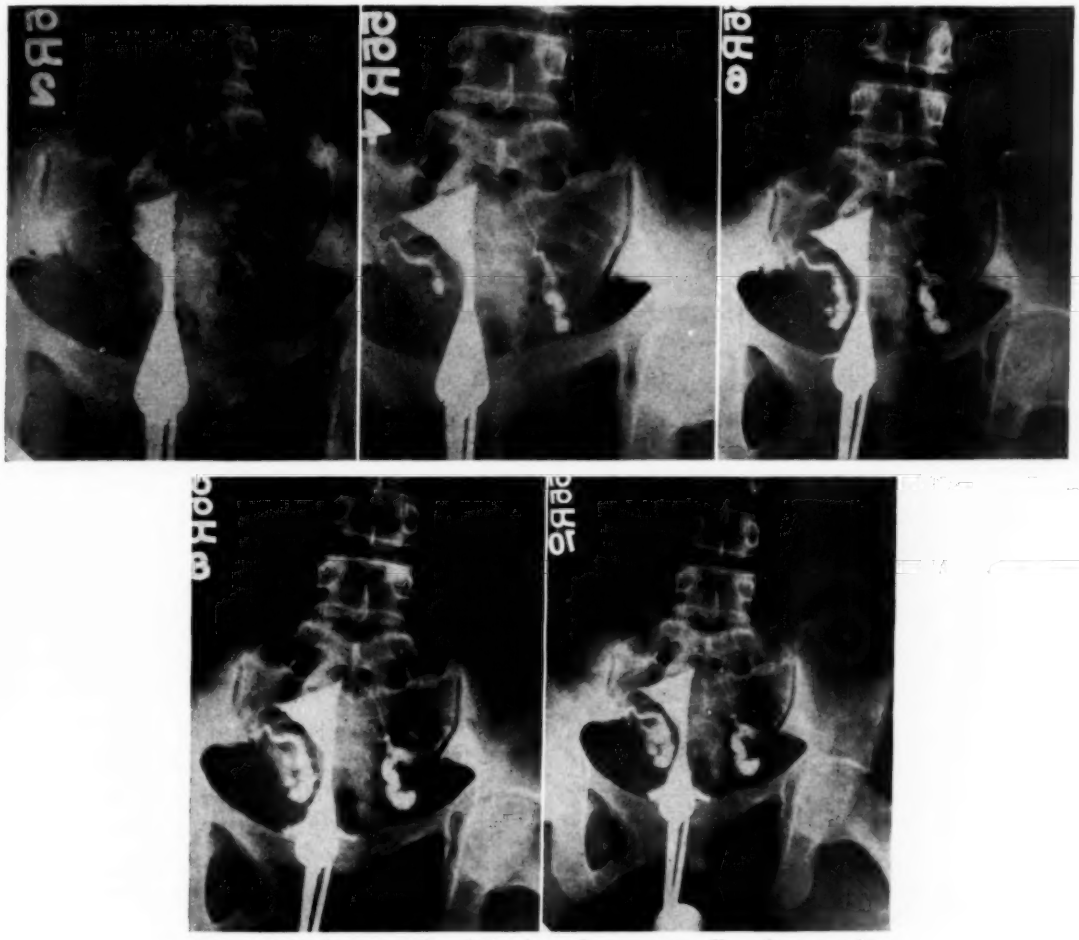

Fig. 5. Serial *x*-rays after injection of opaque medium into uterine cavity.

Each picture represents successively the injection of 2 c.c. of medium (from 2 to 10 c.c.). Progressive filling of uterus and tubes, latter being occluded at fimbriated ends ("clubbed tubes").

The mere finding of motile spermatozoa does not prove that the male is fertile, and this statement cannot be reiterated too often or too emphatically.

The proper examination of a specimen of spermatic fluid[8] must include an estimation of its total volume, its viscosity, an approximate estimate of the proportion of living or motile cells to dead cells, a count of the spermatozoa per cubic centimeter, a differential count showing relative percentages of normal and various abnormal forms of spermatozoa, and finally a timing of the duration of motility of the cells at room temperature.

be stated, however, that insufficient total numbers, or too high percentages of abnormal forms even though these spermatozoa are found to be motile, may cause persistent and prolonged sterility, relieved only when this impaired spermatogenesis has been corrected by active treatment. This treatment has been outlined elsewhere,[1,8] and may need to include the administration of thyroid substance and gonodatropic hormone, certain vitamins, the removal of foci of infection, and prostatic massage.

The point which I wish particularly to make is that the physician who is satisfied

merely with looking through his microscope for motile spermatozoa will make the mistake again and again of overlooking one of the most common causes of relative sterility, namely, abnormal forms of spermatozoa. This is true whether the specimen is collected directly from condom to bottle, or obtained by aspiration from the cervical canal following coitus.

At the same time it may be commented that to find only dead or inactive spermatozoa in a specimen does not necessarily class this man as hopelessly sterile. This finding may be due to some faulty technique in the collection of the specimen, or even when this is not so, may be correctable by treatment.

A total absence of spermatozoa in several specimens is a most unfavorable finding, but likewise not always a hopeless one. This may be caused by urethral strictures or by occlusion of the vas deferens following gonorrheal epididymitis. Both are correctable in certain instances by operative procedures.

ANALYSIS OF CASES

Elsewhere[1] I have reported the results of study and treatment of 67 cases of relative sterility analyzed twelve months after the last registration. In this group, 36 pregnancies resulted, being an incidence of 53.7 per cent. The duration of sterility in these couples was from a minimum of one year to a high mark of fourteen years. In an earlier paper,[11] I reviewed briefly the various faults found while studying this same group.

I desire now to compile briefly the faulty factors found in a new group of cases studied even more thoroughly than the earlier group, giving especial attention to the results of the intensive investigation of the male as already outlined. At this time no report will be made about resulting pregnancies because only a few of these have, as yet, been registered for more than one year and the majority are still under treatment or observation. Consequently, final results cannot be compared at this time with those of the first group.

In this group the greatest number of female faults in any case was seven, of male faults five. The least number of female faults was one, and only 2 males in 50 showed no demonstrable faults. The worst combination was seven female and five male defects in one couple. The average of female faults was 3.55, and of male faults was 2.15 per case.

The commonest female factor of consequence was endocervicitis, while the male defect most frequently found was a higher than average number of abnormal forms of spermatozoa. This last was often associated with hypothyroidism.

We no longer class men having complete absence of spermatozoa or only dead spermatozoa, in the "absolute sterility" group. Enough of these conditions are correctable to warrant considering these men as relatively sterile, unless azoospermia in a given instance be due to blockage of the vas deferens, or atrophic testicles, or some similar, definitely anatomic defect. Consequently it is anticipated that the incidence of pregnancies to be reported in our more recent groups of cases should be somewhat lower than that of our first series, due to this more rigid standard of classification.

SUMMARY

1. Accurate diagnosis of the source of human sterility in a given couple is dependent upon a routine, complete repetition of certain definite investigative steps in both the wife and the husband.

2. None of these may be omitted, even though various major faults may be found, because in every couple a multiplicity of faulty factors, both female and male, is the rule.

3. Relative sterility is correctable in a majority of these instances by active though often simple treatment of these faulty factors, including those that are minor as well as the major ones.

4. Many instances of absolute sterility with gross pathologic changes, in either the

female or the male, are also correctable, but by operative procedures.

5. This paper concerns itself with the problem of outlining minimum necessary diagnostic measures, and their summation. Treatment is briefly discussed, but is usually obvious when the diagnosis is complete and has been carefully summarized. Certain common diagnostic errors are enumerated, with especial emphasis on those committed so often in the examination of the spermatic fluid.

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PREVENTION AND CONTROL OF PUERPERAL INFECTION DUE TO THE BETA HEMOLYTIC STREPTOCOCCUS*

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DURING the past few years much valuable information has been added to our knowledge concerning the etiology of puerperal infection. The sources of infection are quite divergent but because of our newer knowledge concerning the principles involved, it has been possible to effect measures that will decrease the incidence of infection to a considerable extent. This is particularly true of infections initiated by the hemolytic streptococcus and it is this group of infections that should be almost entirely eliminated, as will be subsequently demonstrated.

Present day ideas concerning the sources of infection can be broadly divided as follows: In the first place hemolytic streptococcus infections are nearly always exogenous. The organisms are brought to the genital tract by the attendants, (professional or non-professional), or somewhat less frequently by the patient herself. Secondly, ascending infections which represent a large percentage of the total incidence of the disease are caused by organisms present in the vagina at the onset of labor, the chief example being anaerobic streptococcus infections. They may become invasive during labor or the puerperium because of changes either in the general condition of the patient or in the tissues of the genital tract initiated by labor and the puerperium. Thirdly, contaminated material from the rectum can be carried into the vagina, during vaginal examinations or through operative interference. In instances of infection arising in this manner, such organisms as the colon bacillus, anaerobic gas bacilli (Welch bacillus) and various types of the non-hemolytic streptococcus, may be cultured from the lochia. Fourthly, contaminated urine may spontaneously carry the infecting organisms usually members of the colon group, directly into the vagina. Lastly, we have a less tangible method whereby organisms, due to ineffective sterilization or disinfection, are present on the hands of the obstetrician, the skin of the patient, or on instruments or supplies used during labor or the puerperium, and are carried directly or indirectly to the genital tract of the patient. One or more of these factors may play a role in any given case.

In the present article we shall deal chiefly with the first group cited, i.e., exogenous infections due to hemolytic streptococci. Regarding the other sources of infection suffice it to say that strict observance of the following principles is essential to the reduction of the incidence of the disease.

1. Observance of the strictest possible aseptic surgical technique throughout all stages of labor and the puerperium.

2. Limitation of pelvic examinations as far as possible and making the greatest possible utilization of the available abdominal methods of palpation. When a pelvic examination is indicated, the employment of the rectal technique is less hazardous than a vaginal examination. In the event that the former is unsatisfactory and vaginal examination becomes necessary, it should be carried out under

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aseptic conditions identical to those employed at the time of delivery.

3. Limitation of operative procedures to only the most conservatively approved obstetrical indications. The abuse of such useful procedures as induction of labor, forceps delivery, and cesarean section especially after the onset of labor, might be cited as outstanding examples of operative interference that under certain conditions, which develop with marked rapidity, may be extremely hazardous procedures.

4. The general condition of the patient should be under constant supervision. By this means the incidence of secondary anemia, upper respiratory infections and other complications of pregnancy can be markedly decreased.

5. Prophylactic employment of transfusions during labor and especially immediately following delivery in the presence of excessive blood loss or anemia.

As previously mentioned, in the present contribution I intend to consider chiefly infection due to the hemolytic streptococcus. A brief summary of the outstanding advances that have been more or less definitely established during the past few years, is given below. These investigations are mainly the result of extensive studies carried on by Colebrook and his coworkers,[1–5] Lancefield,[6] Smith of Aberdeen,[7] Paine,[8] Mèleney,[9] Harris and Brown,[10] and others. The concensus of opinion as a result of these studies permits us to make the following deductions:

1. Beta hemolytic streptococci can be divided into different serological groups designated by Lancefield[6] and Lancefield and Hare,[1] as *A*, *B*, *C*, *D*, *F* and *G*, and usually only the members of Group *A* are capable of causing the more severe type of puerperal infection. This probably explains why in the past hemolytic streptococci have been isolated during the puerperium from the genital tract of some patients who were critically ill, and others who were scarcely ill at all.

2. Hemolytic streptococci existing in the vagina prior to the onset of labor usually are of the non-pathogenic variety and are rarely concerned with the production of severe puerperal infection, although the organism may be recovered from the uterine lochia.

3. The type *A* group are found not infrequently in the upper respiratory passages of human individuals and this constitutes by far the most important human reservoir for these organisms. They are most frequently present during acute tonsillitis, scarlet fever and septic pharyngitis. The incidence is also increased in the upper respiratory passages including both nose and throat during mild upper respiratory infections and even *in the common cold* in spite of the fact that these diseases may not be related in any way to hemolytic streptococcus infections.

4. Extensive studies carried on by Colebrook,[5] Smith,[7] and others have practically conclusively demonstrated, in many cases, extensively investigated bacteriologically, that the strain of organism producing the puerperal infection, was identical serologically to a strain harbored in the upper respiratory tract of an attendant or indeed the patient herself, at the time of labor.

With this information available it becomes evident that infection due to this organism should be almost completely preventable. The practical application of these principles would seem possible by the following methods:

1. During the last trimester of pregnancy:
   a. Prevention and elimination of upper respiratory tract infections in the patient herself;
   b. Prevention of the patient coming in contact with other members of the family who have such an infection;
   c. Adequate treatment of any localized infection caused by this organism in other parts of the body such as paronychia, etc., or indeed local suppurative processes, such as middle ear disease in members of the family.

2. During the course of labor:
   a. Routine nose and throat cultures, especially carried out to detect the presence of hemolytic streptococci, should be taken as an initial measure on all members of the nursing and medical staffs. Individuals harboring appreciable numbers of these organisms, especially if they belong to Group A, should desist from caring for the parturient or puerperal woman. Repetition of routine cultures would seem advisable from a practical point of view only under special circumstances. However, each new member of the staff—doctor, nurse or student—should have a negative culture before being assigned to duty.
   b. In the event of the development of an upper respiratory infection of any kind the individual concerned should abstain from active service until such time as cultures become negative for the hemolytic streptococcus. These measures seem necessary because it has been well demonstrated that individuals, who have recently had upper respiratory infections of any kind, harbor a much higher percentage of hemolytic streptococci than individuals who have not had such infections.
   c. In order to prevent individuals who are possible carriers (periodic) or others who are in the early stages of an acute upper respiratory infection, coming in contact with the patient, it should be our duty to see that every attendant, professional and non-professional, who comes in contact with the patient at any time from the onset of labor until the completion of the third stage, is adequately masked. A word of caution is necessary here. In the first place the mask should be of adequate size to completely cover both the nose and mouth. It should consist of enough layers of gauze to produce an effective screen between the attendant and the patient. The masks should be intelligently used and once removed should be discarded, sterilized and laundered rather than being used repeatedly, even by the same individual. Injudicious handling of such a mask by an individual after removal of the same may place more hemolytic streptococci on the hands of the attendant than if the mask had not been used. In other words, the use of a mask can be of great value as will later be demonstrated, in the hands of intelligent individuals, but it has possible disadvantages in the hands of the unintelligent or unscrupulous persons.
   d. The careful application of aseptic principles throughout labor with particular reference to the technique at the time of examinations and delivery. Special attention and constant vigilance are necessary to prevent some patients from infecting themselves by digital contact of the external genitalia.
   e. Employment of isolation technique with the development of intrapartum infection. The same principle of isolation should be instituted in the admission to the hospital of patients already infected. These patients should be delivered in a special delivery room reserved for such use only, preferably on a different floor of the institution.

3. During the puererpium:
   a. The same principles of preventing individuals who have recently had upper respiratory infections from coming in contact with the patient during the first week or ten days of the puerperium should be observed.
   b. All professional attendants carrying out vaginal examinations, diagnostic procedures or nursing care when the perineum is exposed, should wear masks fulfilling the qualifications described in the foregoing.
   c. Patients having an elevation of temperature above 38°C. after the first twenty-four hours postpartum, should be immediately isolated from the afebrile patients and cared for in a separate isolation pavilion. Time should not be allowed to elapse in order to make a diagnosis prior to the transfer of such a patient.
   d. With the development of morbidity cultures should be obtained from the genital tract. These are preferably obtained from the cavity of the uterus which, however, involves a somewhat more complicated technique than the taking of a simple vaginal swab. The latter procedure yields quite accurate information as far as the hemolytic streptococcus is concerned. In other words, if present in the vaginal secretion it is almost certain to be present in the cavity of the uterus. However, this principle does not necessarily apply to many other organisms that may be present in the vagina during the puerperium. Repeated blood cultures will sometimes corroborate these findings.

The isolation technique, to which reference has been made, should be instituted immediately prior to the ascertaining of the bacteriological findings because of the uncertainty of the nature of the infection at that time. The isolation methods employed should be based upon the general medical principles of isolation as laid down for care of infectious and contagious diseases in general. This implies an efficient organization on the part of the medical and nursing professions and the knowledge of the details of this technique and practical methods of following them.

The briefly described principles have been devised chiefly to reduce the incidence of puerperal infection from the hemolytic streptococcus and to prevent its spread to other patients. They will also assist in the prevention of infection due to other organisms that may be harbored in the upper respiratory passages such as many other varieties of the streptococcus and also the pneumococcus. We have rigidly adhered to these principles in the New York Lying-In Hospital since September, 1932. It may be added that we have a constantly changing personnel as regards nursing service, resident staff and students. In spite of this large turnover it has been possible to execute the described principles without adding materially to the cost of operation of the hospital.

Any evaluation of our present results should be compared with those obtained prior to the application of these principles. This is extremely difficult to do because of different conditions prevailing in various hospitals. Some of these differences that prevent accurate comparison can be cited as follows. The incidence of puerperal infection is usually not an accurate figure for comparison because it is a *corrected* figure from the total morbidity, and accordingly in such a correction a variable personal equation of opinion is introduced. Thus for our purposes the total morbidity is much more satisfactory. Unfortunately, however, there is a lack of uniformity in calculating morbidity in different institutions. Such factors, as time and frequency

of recording the temperature, the number of days during the puerperium such observations are recorded, and the arbitrary standard of elevation of the temperature to classify the puerperium as morbid, are very variable. Accordingly, it is possible for two institutions doing comparable work to report an incidence of morbidity from 5 to 40 per cent. Each clinic deals with a different class of patient which in itself alters the morbidity. In general the higher the social and economic plane of the patient the lower the morbidity will be. It is also desirable that bacteriological investigations be carried out on all infected patients in order to evaluate different results and interpret the significance of differences obtained. Because of the obvious impossibility of accurately comparing morbidity and particularly as we are interested primarily in the hemolytic streptococcus infections, I shall only review briefly some recorded statistical studies of bacteriological findings.

Harris and Brown[10] in a study of 113 consecutive patients with puerperal infection from whom streptococci were cultured found 17 instances of infection due to the Beta hemolytic streptococcus. Peckham[11] in a larger series of 545 infected patients from the same institution who were studied bacteriologically found 6 per cent infected with hemolytic streptococci. Hare and Colebrook[3] in 837 patients cultured during the third and fourth day of the puerperium found the hemolytic streptococcus present in 6.2 per cent of the cases. Rivett[12] and his associates found that in 42 per cent of their infected patients admitted to the Isolation Division of the Queen Charlotte's Hospital the hemolytic streptococcus was present.

The latter figure reported by Rivett and his associates certainly is not comparable to the others because they include only a study of the most severely ill patients with puerperal infection, which accounts for the very high percentage recorded. Colebrook[13] has estimated that the incidence of infection in England and Wales due to this organism is in the neighborhood of 10 to 20 cases per 1000 deliveries. He also mentions three London institutions where precautions against this type of infection have been carried out with a resultant incidence of not more than 2 per 1000 deliveries. Colebrook states that during 1934 and 1935 in the Queen Charlotte's Hospital in London, where conditions are far from ideal but an attempt has been made to apply these newer principles, the incidence of infections due to Group *A* hemolytic streptococci, was found to be only 7 instances in 4850 "booked" cases, an incidence of 1.4 per 1000 deliveries.

It has been our custom to study bacteriologically all patients who have a febrile puerperium, i.e., if the temperature reaches at least 38°C. (100.4°F.) on *any* two days of the puerperium, the first twenty-four hours postpartum only being excluded. Not infrequently, we have cultured also patients whose temperature did not fulfil these requirements but who had a definite low grade elevation of temperature. Cultures were obtained nearly always from the cavity of the uterus by means of a modified Little tube and were taken during the first six days of the puerperium, but most frequently on the third and fourth day.

From September 1, 1932 until September 30, 1936, at the New York Lying-In Hospital 10,638 women were delivered of full term or premature infants. During the same period of time we cared for 3538 patients on the John E. Berwind Free Maternity Service, who were delivered in their homes. Febrile patients among the latter group were transferred to the New York Lying-In Hospital where they could be more adequately tended than in their homes. Accordingly, from this total group of 14,176 patients we studied 1132 bacteriologically. Obviously, a considerable number of the total patients studied culturally did not have a puerperal infection, but their febrile reaction was due to some extra-genital cause. However, we were able to isolate the Beta hemolytic streptococcus, producing soluble hemolysin by McLeod's

test,[14] on only 11 occasions, an incidence of slightly less than 1 per cent of the total morbid patients studied in this manner. Expressed in another way the chances of a patient contracting a hemolytic streptococcic infection, in this service, is 0.7 per 1000 deliveries, an incidence of 0.07 per cent.

It is also extremely interesting to note that only one patient died, one death in 14,176 deliveries, due to a hemolytic streptococcus infection. This patient was delivered in her home and later transferred to the hospital. Further analysis shows that 5 of the 11 cases occurred on the Berwind Service of 3538 deliveries, and 6 cases among the hospital deliveries constituting a much larger number of patients (10,638). In other words, the incidence was more than 2½ times as frequent in the home as compared to hospital deliveries. A probable source of infection was determined in 9 of the total of 11 patients with the hemolytic streptococcus infection, and in the 2 remaining patients possible sources of infection were found. Upon analyzing this information it is seen that the source of infection in 3 patients was the upper respiratory passages of a doctor, nurse and student, respectively. In 2 instances it was the patient's own upper respiratory tract. In the remaining 6 instances the probable source of infection was the upper respiratory passages of other members of the family. These findings are not based on the fact that serologically identical strains were isolated from patient and contact, but merely on the finding of a contact with, usually, large numbers of Beta hemolytic streptococci producing a soluble hemolysin as did the infecting strain in the patient. Another interesting finding that confirms some previous observations was that only 2 of the 11 patients who had this organism in their genital tract had an operative type of delivery. In other words, if we take into consideration the operative incidence in this service, we see that that factor was in no way related to the incidence of infection with this organism. This fact further substantiates our previous contention that the source of this type of infection is exogenous and is brought to the patient and can be inoculated without necessarily performing an operative procedure.

SUMMARY

It would seem that the nature and sources of infection briefly reviewed enlighten us regarding many severe and fatal cases of infection occurring in the past, where the obstetrician professed a lack of responsibility, because of the fact that delivery was spontaneous and uncomplicated.

A review of statistics on maternal mortality in this country provides us with fairly accurate information regarding the mortality due to puerperal infection. If one is privileged to assume, which seems well justified, that at least 50 per cent of the mortality due to infection actually represents the cases where the infection is initiated by the hemolytic streptococcus we can at once recognize the significance of the elimination of infection due to this organism.

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UTERINE INERTIA

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PHILADELPHIA

THE most commonly known definitions of "inertia uteri" are: (1) labor prolonged to such an extent as to be dangerous to both mother and child; (2) insufficient contractions of the uterus to overcome the normal resistance of the passage of the child through the parturient canal, which may at times be produced by abnormalities existing in the mother or in the fetus; (3) that condition in which the uterine contractions, by reason of their weakness or irregularity, are insufficient to dilate the cervical os in the first stage of labor, or expel the fetus in the second stage.

In the more recent literature on this subject, inertia uteri has assumed the phrase of "atonic uterus" or "atony of the uterus." This modern conception of the inert uterus defined as "atony," is not as specific or as comparable as the inertia uteri of the older authorities. The word inertia means sluggish, persists in the state of rest, uniform motion unless some force changes that state, which describes well the characteristics of uterine inertia. On the other hand, atonic is defined as lack of tone or vigor, which does not symbolize as well the characteristics of the primary inert uterus, but could well be utilized in defining the secondary type. We shall adhere to the older nomenclature of "inertia uteri" throughout this resume of the subject.

Inertia uteri may therefore be divided into two distinct classes: primary or true inertia uteri, and secondary, or uterine exhaustion. Under these two main classifications we are able to place the etiological factors which produce one or the other of these conditions.

Primary or true inertia uteri is that condition in which the uterine contractions have never been sufficient to throw the uterus into contraction, either before the onset or from the beginning of labor. It is a most unusual type of inertia and probably one of the rarest varieties of prolongation of pregnancy or labor.

Etiology. The primary inertia uteri arises from a variety of conditions such as:

1. Defective intervention (paralysis of nerve center which presides over uterine contractions);
2. Defective development of the uterine musculature;
3. Abnormal shape of the uterus due to uterine abnormalities;
4. Abnormal positions of the uterus as seen in the anteflexions of pendulous abdomens, also in prolapsus uteri;
5. Overdistention of the uterus as in polyhydramnios;
6. Neoplasms of the uterine wall;
7. Adhesions between the embryonal sac and the uterine wall;[1]
8. Rapidly succeeding pregnancies.

As an etiological factor in this condition, Falls[2] explains the atypical types of labor producing habitual abortion due to overstimulation of the pituitary secretions, hypersensitiveness of the pelvic sympathetic ganglia, or a decrease in the normal inhibiting activity of the thyroid. He further states that those cases that tend to go longer than the two-hundred and eighty days may be explained on exactly the opposite grounds; namely, a mild hyperthyroidism, weak pituitary hormone production, or relatively insensitive pelvic sympathetic ganglia. According to this theory, primary inertia uteri may not necessarily be due to abnormalities in the uterus, but may be secondary to failure of the hypophysis to produce sufficient hor-

mone; to failure of the sympathetic ganglia to receive or transmit the proper impulse; or to an overactivity of the thyroid neutralizing the stimulating effect of the pituitary secretion. Who knows but that this recent observation of Falls may not be the only cause of this relatively rare primary inertia uteri. Time and further observation will bring to light more definite information on this particular factor. It is logical to suppose that if overstimulation of the pituitary secretions will produce atypical types of labor, such as habitual abortion, the theory that the failure of the hypophysis to produce sufficient hormone and transmit the proper impulse along with the overactivity of the thyroid, neutralizing the effect of pituitary secretion, may be just as logical.

The older authors claimed that primary inertia uteri implies that the inertia is due to some inherent fault in the uterus and that it is certainly not due to any recognizable cause outside of the uterus, which, in the light of the recent work of Falls, seems not to be entirely so.

It is proposed therefore, to use the term primary inertia uteri in all cases of weakness and ineffectiveness of uterine contractions, except those in which the uterus is in a state of exhaustion and has lost all power of contraction and retraction, a condition resulting from prolonged and powerful action in the attempt to overcome abnormal resistance, and known as secondary inertia uteri.

The primary inertia uteri is more commonly seen in primiparae and next most frequently in elderly multiparae; it occurs more frequently in very young and very elderly women rather than in those of average age.

Contributory Factors. Numerous contributory factors have been described and have been known to exist. As a contributory factor it is considered to be hereditary; common in elderly primiparae, and in elderly multiparae who have many years interval between their pregnancies, in the obese, in delicate women, in invalids, in convalescents from the acute infectious diseases, and in those whose lack of nourishment may be attributed to hyperemesis gravidarum.

Remediable Factors. Those occasionally placed among the causes of primary inertia uteri are, overdistention of the bladder, fecal impaction of the rectum, abdominal tympanitis, and overloaded stomach, all of which have been known to impede or hamper the functional activity of the uterine musculature.

If we go more intimately into defective intervention, the paralysis of the nerve centers which preside over uterine contractions is well explained under Falls' recent work, to which I have already alluded.

Improper development of the uterine musculature can be classed under congenital abnormalities, which are easily recognizable in the underdevelopment of the sex organs and the infantile uterus encountered in such individuals.

Uterus didelphus, uterus biceptus, uterus unicornis and bicornis, are uterine abnormalities which logically do not permit of proper uterine muscular function.

Abnormal positions of the uterus retard its functional activity to guide and expel the uterine contents by the normal mechanism of expulsion. This frequently prohibits the presenting part from entering the birth canal in normal spontaneous relation, and results in abnormalities of position and presentation as well as ineffective muscular contractions which fail to produce the dilatation of the lower uterine segment and cervical os. Likewise does this occur in term pregnancies where the uterus is in complete prolapse.

Overdistention of the uterus as in polyhydramnios, where an excessive amount of fluid is present in multiple pregnancies, and abnormalities of the fetus, causing an overstretching of the uterine musculature which interferes with the normal muscle action of the uterus, producing ineffective contractions and resulting in prolonged labor.

Neoplasms of the uterine wall such as multiple myoma uteri, so infiltrate the

muscle wall that ineffective contractions result.

Abnormalities which occasionally arise between the firm adhesion of the embryonal sac and the uterine wall, as described by Edgar,[1] cause poor uterine muscle action.

The rapidly succeeding pregnancies, where the increase of the connective tissue in the intermuscular interstices gives us the picture of a fibrous muscle seen in the wall of the uterus, results in poor and inefficient uterine contractions.

Management. The management of primary inertia uteri caused by defective intervention of the nerve centers is, in most instances, operative intervention. Likewise the defective development of the uterine musculature, the abnormal shapes of the uterus, and the abnormal positions of the uterus, frequently require surgical intervention. Interference for the draining of the fluid in polyhydramnios cases is often sufficient to bring about and restore the muscle tone. The neoplasms of the uterine wall occasionally so infiltrate and interfere with function of the uterine contractions that rupture of the uterus is to be considered logical when the tumor growths encroach upon and prohibit the presenting part from entering the birth canal. In such cases operative intervention, with at times a Porro cesarean section, is considered the procedure of choice. If the diagnosis of adhesions between the sac and the uterine wall can be made previous to the onset of labor, operative intervention is considered justifiable. In those individuals whose rapidly succeeding pregnancies have produced fibrosis and interference with muscular contraction, it is wiser and safer to allow the uterus to rest itself during the course of labor, rather than embark upon too early operative intervention. Where the pituitary secretions and the overactivity of the thyroid are found to be the etiological factor, the administration of the proper substances may produce a prompt and complete return of uterine muscular activity.

In the active treatment of the contributory factors caution is considered of primary importance. Reasonable time should be allowed for the first and second stages of labor. Intervention by operative procedures is justifiable when the fetal and maternal life is threatened.

In the treatment of the remediable factors, the proper observation, care and treatment of the individual during labor will overcome the potential abnormality and return the uterine musculature to proper functional activity.

Secondary inertia uteri occurs more frequently than primary and is more common in the primiparae whose soft parts are rigid, and is also found associated with any condition, either maternal or fetal, which heightens the resistance of the passage of the child through the birth canal. Among the common conditions causing obstructive inertia or atony of the uterus, we find that any obstruction of the birth canal which exhausts or threatens the muscular activity of vigorous uterine contractions, can be classified as causative factors, as the secondary inertia uteri is characterized by exhaustion of the musculature, atony, or paresis of the structures.

Primary and secondary inertia uteri are not closely related, yet the two forms do possess some factors in common. The secondary type of inertia will give threatening symptoms of exhaustion both in the first and second stages of labor, characterized by the failure of the contractions to cause progressive dilatation of the cervix, which manifest themselves when the contractions occur at longer intervals and are of shorter duration. In the first stage of labor attention is called to the long interval between the pains and the presence of nothing of moment, except the mere delay or prolongation of labor.

In individuals where the liquor amnii has leaked away slowly, the futile efforts of the uterine contractions will often lead to beginning exhaustion. Dry labor which so often results from this too early and slow escape of liquor amnii, is no longer feared, as in the past, but the danger of the tendency for the retraction of the lower uterine segment to form a contraction ring, thus causing dystocia, is not to be overlooked.

Even the failure of dilatation and expulsion of the presenting part may cause a further thinning out of the lower uterine segment and threatening rupture of the uterus.

Of all the etiological factors of secondary inertia uteri which cause uterine fatigue or exhaustion, the commonest are cephalopelvic disproportion, abnormal presentation and lie, malpositions and faulty positions, along with any obstructive lesion of the bony pelvis, maternal soft parts, or fetal structures.

Secondary inertia uteri can almost be prognosticated, if any of the mentioned etiological factors are determined before the onset of labor. It is for this reason alone, that insistence is placed upon having thorough knowledge of what is to be encountered during the course of the first stage of labor, so that treatment of the eventual exhaustion of the uterine musculature can be instituted immediately, when indicated. Serious and even fatal postpartum hemorrhage from an exhausted uterine muscle can in this way, by timely operative intervention, be avoided. All treatment of secondary inertia uteri is based first, on the etiological factor, and second, on the proper conduct of the case to prevent the uterine exhaustion. Rest from the strain of vigorous contractions during the first and second stages of labor is the only treatment indicated, and is in most instances highly satisfactory, if the obstruction is of moderate character. No patient, if the proper treatment is instituted at the onset, should be allowed to enter the realm of extreme fatigue and exhaustion. If such disproportion, malpresentation, or faulty position is found to be present before the onset of labor, or during the course of labor, timely operative interference will prohibit this grave exhaustive relaxation of the uterus. Operative delivery before the uterine musculature threatens fatigue is justified, provided operative intervention at this time does not threaten more serious consequences for the individual. The malicious practice of the administration of pituitary extract hypodermically should never be undertaken to overcome a disproportion, particularly when the cervix is not fully dilated, the membranes unruptured, and the presenting part high in the pelvis, as this procedure increases the risk of maternal uterine rupture and permanent injury to the child.

Secondary inertia uteri is a preventable condition, provided thorough and complete examination has been made and full knowledge of the case is at hand. The primary inertia uteri is likewise a preventable condition if the findings of proper and sufficient examination are recorded and completely and accurately understood.

CONCLUSIONS

Primary and secondary inertia uteri are essentially different and can be deferentiated when the etiological factor and cause of the condition are determined. The primary can well be associated with imperfect development of the structures and abnormalities in construction of the parts, while secondary inertia is more of an atonic condition brought about by the tiring and exhausting uterine musculature. Differential diagnosis between the two is essential in the proper handling of this abnormality.

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DYSTOCIA*

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DYSTOCIA, as the term is generally used, means prolonged and difficult labor. The causes may be grouped under the following headings:

- Abnormalities in Generative Tract
  - Contracted pelvis
  - Obstructing tumors
  - Excessive rigidity of soft parts
  - Faulty uterine contractions
  - Fixation of the uterus
- Abnormalities in Fetus
  - Abnormal or excessive development
  - Faulty presentations
- Accidental Complications
  - Hemorrhage
  - Rupture of uterus

Contraction of the bony pelvis is probably the most frequent cause of dystocia. The occurrence of contracted pelvis is given by various authorities as from 8 to 24 per cent. While the incidence is influenced by racial and other factors, it should not be assumed that the condition is rare in native white American women. The importance of careful pelvimetry in obstetrics can not be emphasized too strongly. No woman should be permitted to reach term without complete pelvic mensuration, including both the inlet and outlet. It should not be assumed that in every case of contracted pelvis dystocia will result; in fact, the majority of such patients will deliver normally. However, it does mean that difficult labor is always a possibility and serves as a warning of possible danger. As will be discussed in more detail under fetal dystocia, abdominal palpation to determine the size of the child and the use of the impression methods described by Müller, Kerr and Pinard are of great value in the recognition of disproportion. It should also be mentioned that stereoscopic *x*-ray views of the pelvis taken at or near term are of value but they can not be depended upon as the sole means of determining the presence or absence of disproportion. In the hands of some, *x*-ray pelvimetry and cephalometry seem to be of real value but the methods employed involve technical procedures too difficult to make the methods widely available.

Dystocia is occasionally caused by tumors that obstruct the birth canal and thus prevent the exit of the child. These tumors are usually ovarian cysts and fibromyomata of the uterus, although bony tumors of the sacrum and carcinoma of the rectum may occasionally act in the same way. Cases of dystocia due to prolapsed cystic kidney have been reported. In the case of ovarian cysts it is impossible to determine until shortly before term whether or not the tumor will cause dystocia. In many instances the tumor which lies in the pelvis in the early months of pregnancy will be pulled up into the abdominal cavity by the growing uterus and at term will be found entirely out of the pelvis. While it may be necessary to remove the tumor during pregnancy because of its size or because torsion of the pedicle occurs, when it is solely a matter of prevention of dystocia most authorities advocate permitting the pregnancy to go to term. The patient is then delivered by cesarean section and the ovarian cyst removed at the same time. The practice of draining ovarian cysts through the vagina is to be condemned without reservation. It is impossible to rule out malignant cysts and, furthermore, it is well known that certain ovarian

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cysts are infected. The removal of the contents of such cysts with a trocar inserted through the vagina is attended with the additional danger of injury to the rectum and ureters. It should be emphasized that a thorough pelvic examination should be done in every case of pregnancy about six weeks before the calculated date of confinement. The writer recalls one case in which the ovarian cyst was apparently too small to be recognized in the early months of pregnancy but which grew to sufficient size to cause rupture of the uterus in labor.

Dystocia due to fibromyomata of the uterus is not rare. As in the case with ovarian cysts, the usual occurrence is for the fibroid nodules to be pulled out of the pelvis as the uterus increases in size during pregnancy. It is, therefore, impossible to predict dystocia in such cases until shortly before term. Unless it becomes necessary to remove the tumor for other reasons during pregnancy, it is generally advisable to permit the patient to go to term and effect delivery by cesarean section followed by myomectomy or hysterectomy.

Fig. 1. Method of determining degree of disproportion by ascertaining the extent to which the head overrides the symphysis. (Stander, H. J. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

Dystocia due to excessive rigidity of the soft parts of the pelvis is rarely encountered but frequently diagnosed. Occasionally dystocia may occur due to an abnormally

rigid pelvic floor, especially in patients who have been subjected to extensive pelvic plastic operations. However, such a com-

Fig. 2. Uterus removed by supravaginal amputation following cesarean section necessitated by myoma in posterior wall of cervix. × ½. (Stander, H. J. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

plication does not arise until late in the second stage of labor and can be overcome readily by episiotomy and the application of forceps. Dystocia due to abnormal rigidity of the cervix is of very rare occurrence unless previous surgery on the cervix, such as amputation, deep cauterization or extensive plastic repair, has been done. Such operations occasionally result in so much scarring of the organ that normal dilatation can not be accomplished. For this reason such operative procedures should not be performed on women in the childbearing age unless accompanied by sterilization. In the rare instances of true primary cervical dystocia delivery by cesarean section of the low cervical or radical type is advisable unless the cervix is sufficiently dilated to permit its incision according to the method described by Dührssen.

It has been stated that true primary cervical dystocia rarely occurs but is frequently diagnosed. The mistake is made of confusing dystocia due to weak and ineffective uterine contractions with that due to rigidity of the cervix. The former is of frequent occurrence and probably is exceeded in frequency only by dystocia due to contracted pelvis. Our knowledge of the cause of labor and the developmental defects in the musculature and innervation of the uterus is still too little to offer a satisfactory explanation for the occurrence of this complication. The case of an otherwise normal woman having such ineffective uterine contractions as to prolong labor unduly presents a problem that truly taxes the judgement of the most experienced physician. The contractions are severe enough to make the patient thoroughly uncomfortable and the usual result is that pressure is brought to bear on the physician by the patient and her relatives to interrupt or hasten the labor. It is safe to say that few complications of labor are so frequently mismanaged. It can not be emphasized too strongly that obstetrics can not be practiced by the clock and the duration of the first stage of labor alone is never an indication for its termination. Cesarean section, manual dilatation of the cervix, delivery by forceps through the incompletely dilated cervix, the injudicious use of pituitary extract, procedures frequently employed in such cases, are to be condemned without reservation.

When labor has continued for twelve or more hours without satisfactory progress due to weak contractions, morphine in sufficient dosage to secure four to six hours of sound sleep should be administered. In most instances, the period of sleep is followed by the onset of adequate and effective contractions and satisfactory termination of the labor. The administration of small doses of pituitary extract, preferably

by nasal absorption, at times proves of value but, when so used, the patient must be watched with great care to prevent overstimulation of the uterus. It must always be remembered that the patient in labor is consuming her caloric and water reserves at a rapid rate. Therefore, in the event of prolonged labor every effort must be made to see that adequate food and fluids are administered. If they can not be taken by mouth due to persistent nausea then glucose should be administered parenterally.

A somewhat rare cause of dystocia in labor is encountered following fixation of the uterus in the pelvis or abdominal cavity. Incarceration of the pregnant uterus in the pelvis usually results in abortion but a few such cases have been known to go to term. The cervix becomes so displaced that delivery through the natural passages becomes impossible. Obviously, such cases should be prevented by manual replacement of the retrodisplaced uterus in the early months of pregnancy. Likewise, severe dystocia usually follows operations which densely fix the uterus to the anterior abdominal wall, again for the reason that the cervix becomes displaced to such an extent that proper dilatation can not occur. When encountered such patients can only be delivered safely by cesarean section but, needless to say, operations that fix the position of the uterus or abnormally

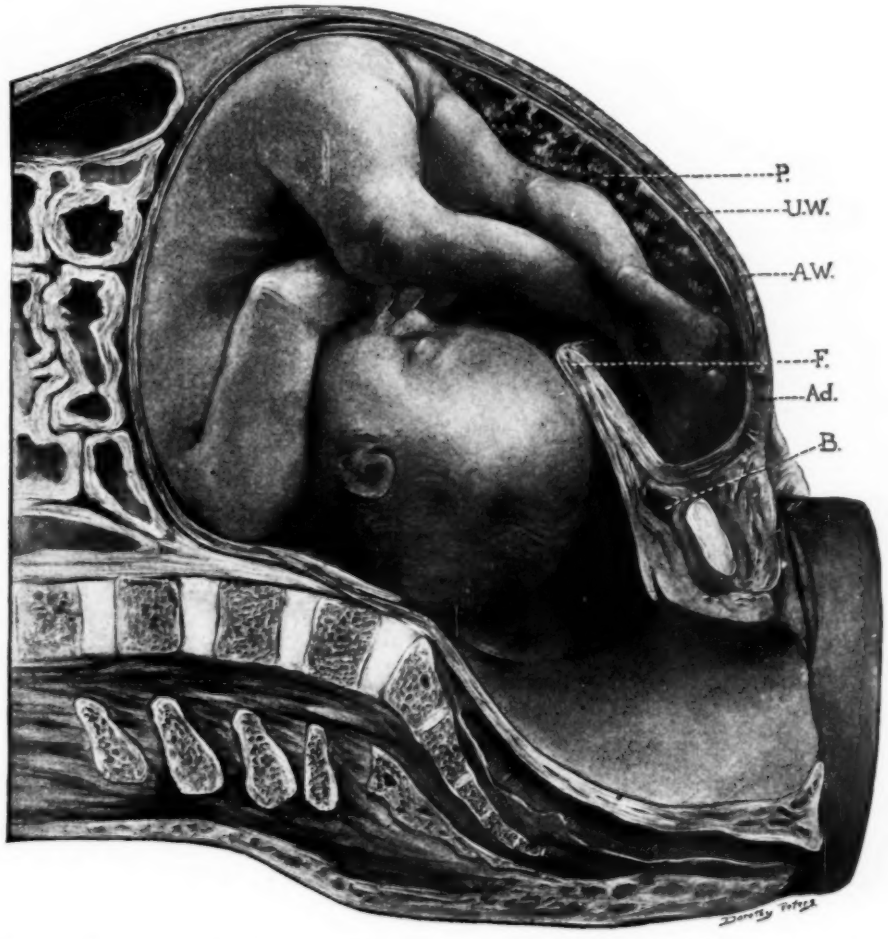

Fig. 3. Dystocia following ventrosuspension. sacculation of anterior uterine wall. × ⅓. *Ad.*, adhesion between uterus and anterior abdominal wall; *A.W.*, abdominal wall; *U. W.*, uterine wall; *B.*, bladder; *F.*, folded anterior uterine wall; *P.*, placenta. (Stander, H. J. Williams' Obstetrics, Ed. 7. New York, D. Appleton-Century Co., 1936.)

angulate the cervix should never be done on women in the childbearing age without tubal sterilization.

Dystocia due to abnormal development of the fetus is occasionally encountered, the most frequent types in such cases being hydrocephalus and double monsters. The possibility of maldevelopment should be remembered when the head fails to engage at term and it becomes impossible to impress it in the pelvis. Likewise, the frequency of hydramnios in cases of fetal monstrosity should be recalled and the latter suspected when the amount of amniotic fluid becomes excessive. The radiograph is of invaluable assistance in the recognition of many forms of fetal monstrosity.

Excessive development of an otherwise normal fetus still remains a frequent cause of dystocia, although it is difficult to justify the occurrence of such cases. If the pelvis is normal in its various diameters, dystocia due to a baby that is too large will not occur unless the weight of the child exceeds ten pounds and this is rarely seen except in cases of postmaturity. Every pregnant woman who goes past the calculated date of confinement should be examined thoroughly at frequent intervals, preferably twice a week, and every effort made to determine the size of the child in relation to the size of the mother's pelvis. As long as the head is engaged or can readily be impressed into the pelvis, no difficulty will be encountered due to the size of the child. However, if it is found that the presenting part is impressed into the pelvis with increasing difficulty, then labor should be induced. The practice of inducing labor solely on the history of postmaturity is to be condemned because of the notoriously inaccurate histories obtainable in many such cases. On the other hand, it is equally reprehensible to permit a patient whose pelvis is normal to continue the pregnancy so long past the calculated date that the baby can not be born with safety through the natural passages.

Abnormal presentations which give rise to dystocia are largely limited to the transverse, brow and face varieties. Except in rare instances, dystocia will inevitably result in the first two types unless the baby is unusually small. In the case of face presentations dystocia is not often encountered unless there is posterior rotation of the chin into the hollow of the sacrum. Careful abdominal palpation done in the last few weeks of pregnancy usually results in a correct diagnosis of the abnormal presentation and permits the institution of corrective measures. Certainly such abnormal presentations should be recognized early in the second stage of labor so that version and extraction can be done with safety before the uterus becomes so tightly applied to the body of the child that there is likelihood of rupture of the uterus if such an operative procedure is attempted.

Dystocia due to such accidental complications as premature separation of the normally implanted placenta, placenta previa and rupture of the uterus will not be discussed in this paper and are added only for the sake of completeness. Obviously, the treatment is directed to the primary complication and dystocia is solely incidental.

CONCLUSION

Dystocia, while due to a variety of causes, is usually predictable and can be prevented in the majority of instances. The prevention consists in thoroughly efficient prenatal care with special emphasis on pelvic mensuration, abdominal palpation and pelvic examination.

THE FLOATING HEAD

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WHEN the vertex does not engage or come into the pelvis it is known as a "floating head." In other words, the greatest diameter of a fetal head is above the plane of the superior strait and at the time freely movable. On abdominal palpation it is felt as a movable body above the superior strait. On vaginal or rectal examination the presenting part is not easily palpable.

In primiparae, engagement usually occurs from two to three weeks prior to the onset of labor. About this time the head should descend into the pelvic canal so that its most dependent portion lies on a line just above the ischial spines. When labor begins, on examination, the dependent portion of the head will be felt on a line with the ischial spines, and more or less fixed in that position. If a primipara approaches her expected date of confinement and it is found that the head is floating, an attempt must be made to discover the cause.

However, this does not hold true in a multipara as engagement does not occur until the onset of labor. Before the onset of labor the head usually is unengaged. It is only after labor has begun and continued awhile that a floating head in a multipara need cause apprehension.

Whether it be a primipara or a multipara in labor with a floating head, the accoucheur must observe one cardinal rule: if possible he is to make no vaginal examinations, unless it is deemed necessary to re-check the diagonal conjugate diameter. This is a time when he is to keep out of the vagina except in carrying out a definite procedure for the treatment of this condition. Naturally, if vaginal examinations are to be made the attendant must observe the strictest rules of cleanliness—the strictest adherence to a surgical aseptic technique must be followed. If after diagnosing a floating head, the obstetrician blindly and casually invades the birth canal without a fixed method of attack, he is guilty of meddlesome midwifery and is to be condemned. The birth canal, except under the rarest circumstances, must be left alone and not even potentially infected. A persistently floating head usually is an indication for cesarean section.

Often, no reason can be discovered for a head not engaging. That there must be an underlying cause is apparent, but often even those most expert and skilled will fail to solve the problem. However, in the majority of instances, the cause will be found, and often the treatment will depend on this.

To consider the floating head thoroughly and in detail would be to write no small portion of the average textbook on obstetrics. In the clinical consideration of the subject we must confine ourselves to the types commonly met, and merely outline a mode of treatment.

To simplify the discussion of this topic, the following causes for a floating head are offered:

PRIMIPARA

1. Disproportion;
2. Abnormal presentation;
3. Abnormal pelves;
4. Tumors of (a) uterus, (b) ovary, (c) kidney (uncommon); (d) spleen (rare);
5. Hydramnios;
6. Uterus didelphys;
7. Placenta previa (uncommon);
8. Large bladder stone (rare);
9. Short umbilical cord (rare);
10. Old extra-uterine gestation sac (rare).

MULTIPARA

1. Disproportion. If previous labors were normal and operative interference was not required then subsequent labors usually terminate normally. If section was necessary for the first birth, subsequent labors will end in section, except the labor is premature or the baby is very small.

2. Abnormal presentation. With a history of previously spontaneous labors subsequent labors usually will be normal.

3. Abnormal pelves. Although previous labors were normal, bone or joint changes may have occurred since then making future labors abnormal.

4. Pendulous abdomen with marked anteflexion of the uterus.

5. A fixed uterus, the result of previous operations for the correction of uterine displacement.

(Items 4, 5, 7, 8, and 9 in primipara included in multipara.)

Many of the named causes are so rarely, if ever, seen by the average man, that we will mention them only in passing.

The most frequent cause of floating head is a disproportion between the size of the mother's pelvis and the fetal head. When the baby's head is larger than the pelvis through which it must travel, birth via natural channels is impossible. When a head is floating, disproportion must be one's first thought, especially in primipara. It must not be forgotten in multipara, even though previous labors were normal, for during the interval between labors bone tumors or other orthopedic conditions may have occurred.

Diameters of the normal female pelvis and of the normal fetal skull are common student knowledge. The man in practice should know how to estimate the size of a female pelvis and anticipate forthcoming trouble when certain measurements are at wide variance from the normal. This is a part of prenatal routine.

An old rule that seldom fails is that a head that engages usually will come through and end in a spontaneous labor. The one exception to this rule is when the mother's pelvis is markedly of the funnel type. In such cases the head may engage but trouble is encountered when it reaches the ischial spines and outlet. With many section is warranted if the distance between the tuber ischii is less than 8 cm. Our rule is to add the bisischial diameter and the posterior sagittal diameter of the outlet and if their combined measurements are less than 15 cm. then, section is indicated.

If a head is floating and doubt exists as to whether or not it will "come in" the following maneuvre is of value. With the patient anesthetized, though sometimes in multipara this is not necessary, the obstetrician seizes the head (brow and occiput) of the child with his fingers through the abdominal wall, and attempts to push the head into the superior strait. If no severe disproportion exists usually the head will engage. The *x*-ray may sometimes aid materially in evaluating disproportion, but, unfortunately, pelvic cephalometry and roentgenometry are possible in only a few places in our country. It, therefore, is out of the question for a man far removed from such centers to take advantage of this aid. In time, we hope, every hospital and maternity service having an *X*-ray Department will make the estimation of the size of a mother's pelvis and of her baby's head an everyday practice.

All efforts at correction having failed and the head remaining floating, section may be indicated.

In an unengaged head, due to the absence of the ball-valve action during contractions, pressure is directed directly on the membranes causing their premature rupture. When the membranes have ruptured it may be a wise policy to try a trial labor of from four to six hours, if the pains are fairly strong and occur at least every ten minutes. However, we suggest this for trial only in borderline cases.

Should the baby be large and the pelvis normal, then a test of labor up to the point of full dilatation for two hours (the membranes ruptured) is in order.

When the disproportion is due to a hydrocephalic head, after full dilatation of the cervix, craniotomy is indicated.

But whether one resorts to a trial or a test of labor, scrupulous care must be exercised not to contaminate the birth canal. After rupture of the membranes labor should not be permitted to continue too long. A long labor, the membranes ruptured, is a contraindication to section. Such a woman is potentially, if not actually infected, and classical section usually terminates disasterously. To be successful, cesarean section must be done fairly early in labor.

In abnormal cephalic presentations, as occipitoposterior, brow or face, sometimes the head fails to engage. Usually a correction will be made as labor continues; or, the attendant will correct the presentation after which engagement is usually the rule. Once engagement occurs the progress of labor varies in each individual case. In multipara, with a history of previous normal labors, should a head not engage and cannot be made to engage, other findings being negative, version and extraction may be done.

Sometimes in an overriding, unengaged head, the anterior portion of the head forms a tumor which exaggerates the overriding. When this occurs and it is allowed to persist, engagement cannot occur. Overriding often is caused by a faulty or high inclination pelvis, and usually early during labor the head can be directed into the pelvis. Neglect makes this tumorous mass on the baby's head possible and if engagement is rendered impossible, resort to operative interference will be necessary.

A child's head may be normal and flexed, but due to a marked pelvic deformity it cannot engage. Experience often teaches us in which cases section will be necessary, and in which ones normal labor will result.

As a rule section will be necessary in osteomalacic pelves.

In spondylolisthetic pelves, spontaneous labor will occur if the deformity is minimal; otherwise, in the interests of both mother and baby, it is best to resort to operative measures. The degree of deformity of a pelvis often increases with age, and while previous labors were spontaneous, a later pregnancy may be abnormal and natural birth impossible. If the pseudoconjugate is more than 8 cm. there is a possibility of a normal labor; when it is below this figure, a cesarean section usually has to be done.

In coxalgic pelves engagement often occurs, but if it has not occurred during the last weeks of pregnancy (in primiparae) the patient should be examined under an anesthetic, and the pelvis carefully palpated.

In these crippled and deformed women it is surprising how often the most grotesque will have a spontaneous labor.

In cases of marked disproportion and pelvic deformities, especially in borderline types, we do not practice prophylactic version; nor do we induce labor prior to term.

The most common uterine tumor that causes unengagement is a fibromyomata. If a fibroid is located interstitially in the lower uterine segment and of sufficient size to block the birth canal, it is apparent the baby will have to be delivered by abdominal section.

Often a subserous fibroid, preventing engagement, will be pulled up in the pelvis during the early course of labor, thus allowing the head to engage. If the tumor is pedunculated, as a rule it can be pushed above the presenting part, after which engagement occurs, and the labor proceeds normally. It is not common practice among skilled obstetricians to resort to cesarean section when a fibroid is in the pelvis. Time, patience, and at times manipulation will obviate the necessity of surgical interference.

As a rule ovarian tumors of sufficient size to interfere with engagement are discovered fairly early during pregnancy. When a woman is found to have an ovarian tumor larger than a grapefruit before the eighth month of pregnancy it should be removed. Due to their habit of rapid

growth, and the possibility of complicating labor, it is a poor plan to neglect them, and take the chance they will cause no trouble when term is reached. On the other hand, if an ovarian tumor is not diagnosed until after the eighth month of pregnancy it is wise to do nothing but wait for labor to begin, and then meet the indications as they arise. If an abdominal section is done too close to term there is danger to the recent abdominal scar, because of the part the abdominal muscles play during labor. If an ovarian tumor prevents engagement and a normal birth is thereby made impossible, then, section, plus removal of the ovarian mass will be necessary.

Tumors of a kidney mechanically complicating labor are uncommon. Such tumors may cause a dystocia by shifting the perpendicular axis of the uterus to an oblique axis, and in this manner preventing engagement. This may be true, also, of any abdominal tumor, although these are so rare we need consider them no further. The writer, over twenty years ago, saw a young primipara with a large mass in the upper, left quadrant of the abdomen. It caused an obliquity of the uterine axis and the head would not engage. Today, this would have caused us no end of concern, but inexperience makes for fearliness. Accordingly, we did a version and extraction without untoward results. Later, a large left kidney was removed at operation, which proved to be filled with echinococcus cysts, a rare finding, especially of the left kidney.

Tumors of the spleen reaching into the pelvis and interfering with the progress of labor are most rare. The same is true of excessively large bladder stones preventing engagement. If one should meet with them they are to be crushed and removed prior to the onset of labor. We have not mentioned a pregnant uterus in a hernial sac, thus making labor impossible, because this condition, also, is almost unheard of.

It is possible, but rarely so, for a placenta previa to prevent engagement. If it should occur the previa takes precedence and treatment is directed towards it, and the floating head becomes of secondary importance.

We mention in passing the fact that an old extrauterine gestation sac can be a cause of a floating head. But we doubt if the diagnosis could be made before operation.

It is possible that if an umbilical cord is excessively short it can prevent engagement; also, that manual manipulation in such a case will fail to make the head engage without putting the baby in jeopardy. Whenever all other findings are negative a short cord should be kept in mind. However, in actual practice it is impossible to make such a diagnosis before delivery.

Hydramnios seldom is a cause of unengagement, although it does occur. Usually it is complicated by an abnormally formed fetus. Puncture of the membranes should be done and labor permitted to proceed. Sometimes the labor is tedious, and at other times precipitous.

Pregnancy in a didelphys uterus is not uncommon, and most of these pregnancies go to term and have a spontaneous labor. When dystocia occurs it is due chiefly to the enlargement and incarceration of the nongravid side behind the pregnant uterus. Unengagement with faulty rotation is of common occurrence. The nongravid horn may encroach directly upon the birth canal and shut it off from the presenting part, or it may displace the axis of the pregnant uterus from that of the pelvic canal. When unengagement persists, operative interference is necessary.

In multipara, it is common to note unengagement in obese women with pendulous abdomens. Often a pendulous abdomen will cause an acute anteflexion of the gravid uterus, causing the head to float. These cases usually are easily corrected. With the patient lying on her back, the pendulous portion of her abdomen is held up or pushed back, and the head is pushed into the pelvic canal, after which a tight abdominal binder is applied. When these things are accomplished successfully, labor

proceeds normally. If these measures fail in their purpose and the head remains unengaged, version and extraction offer a solution.

Two decades ago various complicated operative procedures were in vogue for the correction of a displaced uterus. For the most part, present day gynecologists have relegated 95 per cent of these operations to the limbo of forgotten things. However, there still is the surgeon who suspends or fixes a uterus in a woman still in the childbearing age. Many of these procedures will make future childbearing pathological. When pregnancy occurs after certain ventral fixation operations, the uterus at term is acutely flexed, and the fetal head cannot engage; neither can it be maneuvered into engagement. Cesarean section is the only way out of this complication.

CONCLUSIONS

An outline of the maternal and fetal abnormalities causing a floating or unengaged head and suggestions as to methods of treatment when this abnormality of presentation occurs, are offered. Emphasis is laid on the warning not to make vaginal examinations when a floating head is diagnosed. If vaginal manipulation is absolutely necessary it should be done only under the most rigid aseptic conditions—to the point of surgical cleanliness. Women with the fetal head floating must not be neglected and allowed to have long labors for fear of potential, if not actual, infection. Some of these cases of persistent floating head, especially in primipara, call for cesarean section.

NEWER ASPECTS OF PELVIMETRY*

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NEARLY three-quarters of a century ago Hugh L. Hodge,[1] wrote "many physicians have placed great confidence in the external measurement of the pelvis, but this is liable to many errors, even from the varying conditions of the external tissues, and can in no case give any exact idea of the form or dimensions of the pelvic cavity." Not until our own day however have we realized the truth of this statement for only through the medium of the roentgen ray has accurate measurement of the pelvis become possible. As the result of a comparative survey of external and roentgenographic measurements made in 1933 it became evident that, although the usual external measurements might serve as indicators of the conformation of the superior strait they were often misleading and to "classify pelves by means of the four external measurements usually taken is erroneous and illogical."[2] The results of this survey and those of others in which roentgenometric methods have been employed make us realize the truth of Hodge's statement.

Our experience with roentgenographic pelvimetry has extended over fifteen years and during this time we have gained information which seems to have practical application. It is the purpose of this paper to discuss some of these practical points. We have found the technique known as the grid method, which has been developed in our clinic, accurate, rapid and inexpensive, and references[3–4] are included for those who may be interested to employ it. It might be pointed out that from the anteroposterior and lateral roentgenograms obtained, we are able to plot the anteroposterior and lateral outlines of the pelvis in their true proportions in both anteroposterior and lateral aspects. These graphs may be incorporated with the prenatal record so as to be readily available at the time of labor (Figs. 1 and 2).

Early in our experience we became aware of the frequent occurrence of pelves which differed from the usual concept of the "normal" female pelvis. In these pelves the relation of the lengths of the anteroposterior and transverse diameters of the superior strait differed from that which had hitherto been regarded as normal. In some pelves the length of the anteroposterior diameter was found to exceed that of the transverse (dolichopellic type). In 1932,[5] and again in 1933,[6] the significance of these findings was emphasized and their importance was confirmed by Caldwell and Moloy.[7]

I am of the opinion that every physician practicing obstetrics should have an understanding of these pelvic variations and without going into too great detail, I wish to offer what has proved a satisfactory working classification. This classification, derived from the configuration of the superior strait, is not a new concept but is based upon the grouping suggested by William Turner in a paper published in 1885 entitled "The Index of the Pelvic Brim as a Basis of Classification."[8]

From a practical standpoint there are four (three main, one subsidiary) variations in the shape of the superior strait, namely:

1. Pelves in which the anteroposterior diameter is longer than the transverse diameter;

2. Pelves in which the anteroposterior diameter is equal to, or but slightly less than the transverse diameter;

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3. Pelves in which the anteroposterior diameter is moderately shorter than the transverse diameter;

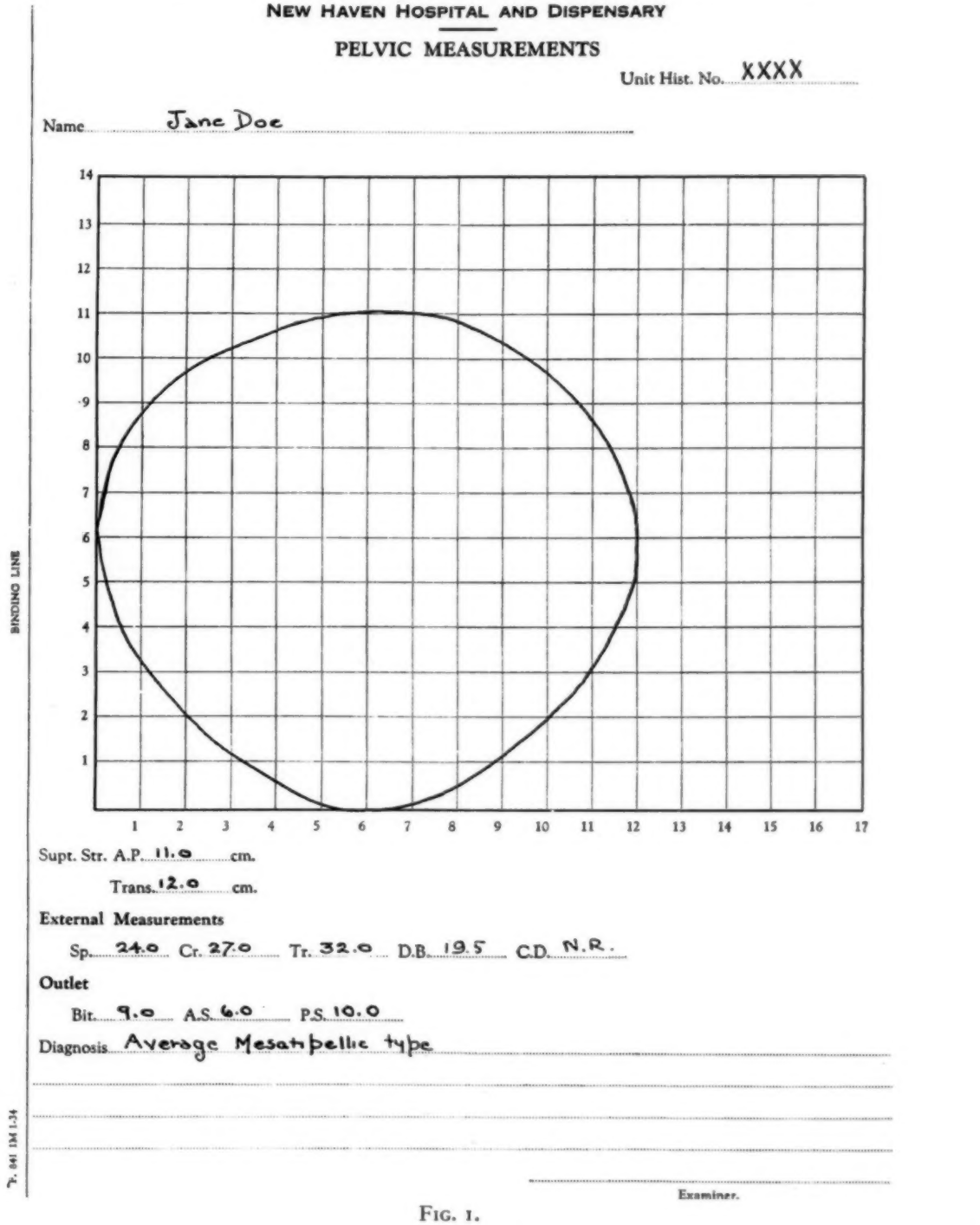

FIG. 1.

4. Pelves in which the anteroposterior diameter is excessively shorter than the transverse diameter.

A diagramatic representation may be studied in Figure 3. To these four types of pelves the following Greek derivatives lend themselves admirably and this nomenclature should become familiar:

1. Dolichopellic type or anthropoid pelvis
2. Mesatipellic type or round pelvis,
3. Brachypellic type or oval pelvis,
4. Platypellic type or flat pelvis.

The subsidiary group noted is group 4. Pelves of this group are designated platypellic only when the transverse diameter exceeds the anteroposterior by 3 cm. or more. These pelves are comparatively rare, and are generally the result of rickets. In our series of 371 pelves in primiparous patients (334 white, 37 colored) there were but 13 such pelves, or 3.5 per cent. Therefore, in considering a further subdivision of our classification we will consider the first three groups, as they occur with relative frequency.

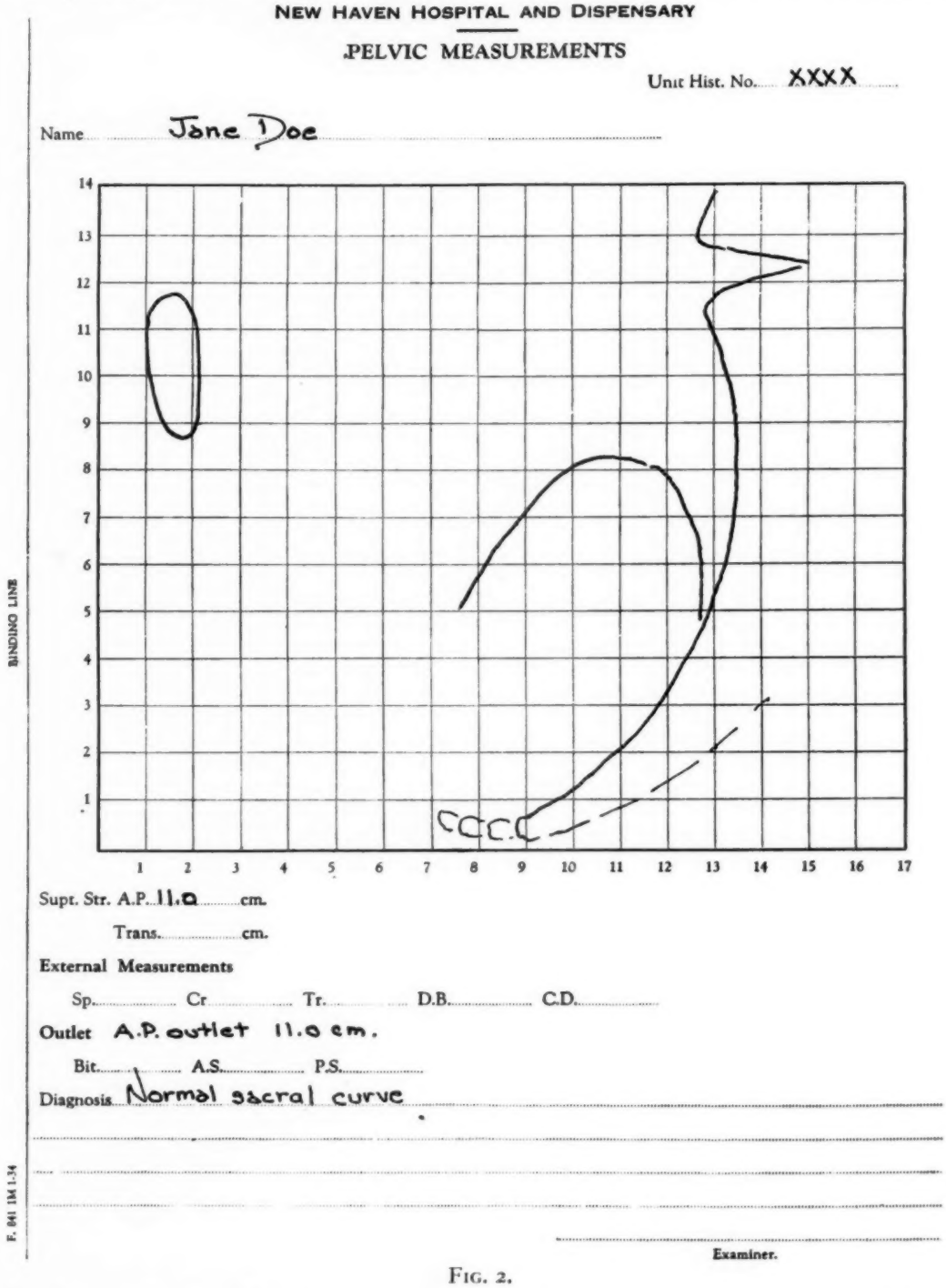

FIG. 2.

It becomes obvious that pelves of each type will be found which are relatively large, average and small. For differentiat-

ing these pelves the length of the anteroposterior diameter is an excellent measuring rod.

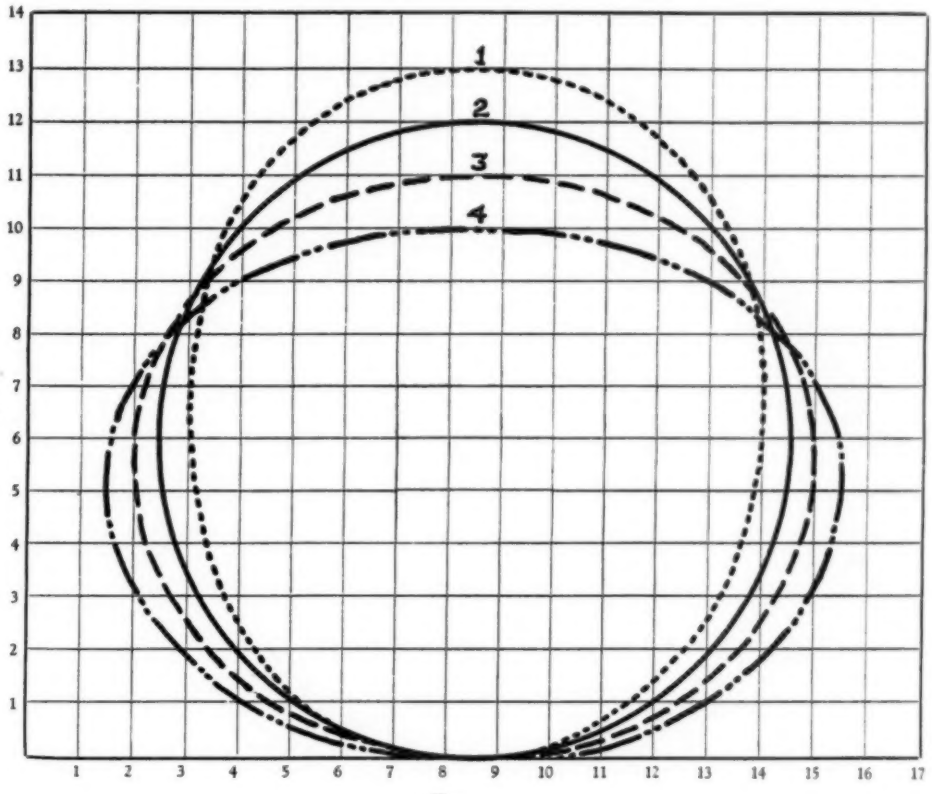

Fig. 3.

Type I. Anteroposterior diameter 14 cm. or more, Large Dolichopellic or Anthropoid Type

Anteroposterior diameter 12 cm. or less, small Dolichopellic or Anthropoid Type

Anteroposterior diameter between 12 cm. and 14 cm., Average Dolichopellic or Anthropoid Type

Type II. Anteroposterior diameter 13 cm. or more, Large Mesatipellic or Round Type

Anteroposterior diameter 11 cm. or less, Small Mesatipellic or Round Type

Anteroposterior diameter between 11 cm. and 13 cm., Average Mesatipellic or Round Type

Type III. Anteroposterior diameter 12 cm. or more, Large Brachypellic or Oval Type

Anteroposterior diameter 10 cm. or less, Small Brachypellic or Oval Type

Anteroposterior diameter between 10 cm. and 12 cm., Average Brachypellic or Oval Type

It will facilitate an understanding of the above if we realize that the criterion for each group is a shortening of the anteroposterior diameter by 1 cm. thus,

Large Dolichopellic Type 14 cm. or more, Small Dolichopellic Type 12 cm. or less;

Large Mesatipellic Type 13 cm. or more, Small Mesatipellic Type 11 cm. or less;

Large Brachypellic Type 12 cm. or more, Small Brachypellic Type 10 cm. or less.

In view of this newer knowledge of pelvic architecture we may ask what should constitute a reasonable survey of the pelvis during the prenatal examination. Much information may be gained from an appraisal of the general stature and constitution. Does the patient favor the leptosomatic or "long-thin" body type, or does she favor the pyknic or "short-stout" body type. The first type has a clinical reputation for being a good labor-athlete, while the latter type when pronounced may

possess features of the dystocia dystrophia syndrome emphasized by Cornell,[9] whose excellent exposition of this subject should

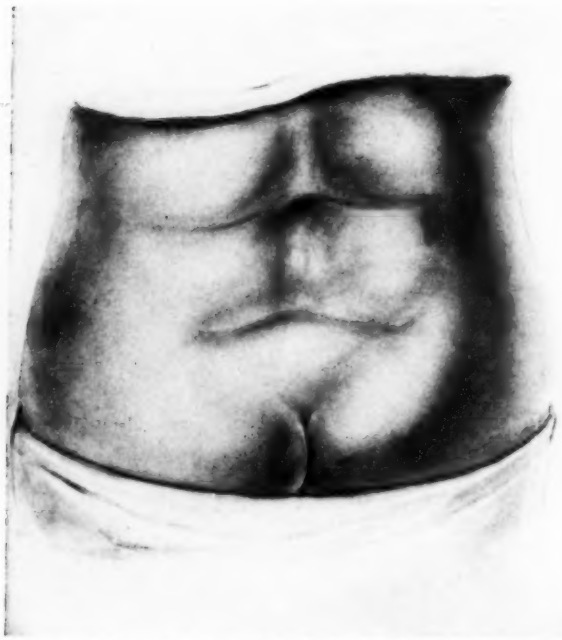

FIG. 4. Flattening of Michaelis' Rhomboid in flat rachitic pelvis.

be familiar. The leptosomatic type is often associated with the dolichopellic and mesatipellic types of pelves while the pyknic is often associated with the mesatipellic and brachypellic types. In our visual survey of the patient any evidences of childhood rickets should of course be noted. The conformation of Michaelis rhomboid should be studied. If, with the patient standing, the greatest length of this lozenge shaped area is vertical, the associated pelvis is apt to be dolichopellic or mesatipellic; if the greatest length is horizontal the pelvis is likely to be mesatipellic or brachypellic. When the rhomboid is distinctly flattened from above downward a platypellic type of pelvis is usually present (Fig. 4).

The vaginal examination intelligently done is most important and should be made early in pregnancy. The examining finger should palpate the anterior surface of the sacrum, noting any abnormalities in curvature especially those associated with rickets. The position and angle of the coccyx, the width and shape of the sacrosciatic notch and the relative space between the ischial spines should be ascertained. The importance of a knowledge of the dimensions of the lower pelvis is here emphasized and the recent important work of Hansen[10] should be familiar. The diagonal conjugate should be measured unless the rigidity of the soft parts and the discomfort of the patient make this maneuver impossible. The lower pelvis may be so readily palpated that a little experience soon gives a good idea as to its available space.

The usual four maneuvers of external pelvimetry may be performed, but the external conjugate or Baudeloque's diameter only is of significance, and a measurement of 18 cm. or less suggests the presence of a small pelvis. The lengths of the intertuberal and posterior sagittal diameters of the outlet may indicate a contracted outlet. When the former is 8 cm. or less in length the pelvis is designated as of the funnel type with which arrest at the outlet and deep perineal lacerations are definitely associated.

For the past two years we have measured by roentgenometry the pelvis of every primipara who has entered our prenatal clinic, and in this way we have gained a great deal of knowledge concerning the occurrence of variations in the pelvis. In addition, this clinical experience has facilitated much of our method of procedure. As a result of our studies and clinical experience we are convinced that the lengths of the diameters of the pelvic inlet of every primiparous patient should be determined in this way. We have taken many lateral roentgenograms for investigative study, but because of the expense we have not adopted this method as a routine procedure. We believe that the lateral views in addition to anteroposterior views are most valuable when the pelvis falls into the borderline group, when abnormalities of the sacrum suggest rachitic changes, or in certain patients, the head fails to engage at term.

When we possess accurate information respecting the size and configuration of the

superior strait, the available space in the lower pelvis, the shape of the pubic arch, and the character of the pelvic outlet, we have a practical understanding of undoubted value in prognosticating the proper conduct of labor. For example it is no small comfort to know whether the superior strait is adequate in primiparous patients who reach term with the fetal head still unengaged. Again the elimination by these methods of the so-called "test of labor" will ensure more satisfactory results in patients delivered by cesarean section.

In a recent series of 371 primiparous patients consecutively delivered at term (child 2500 grams or over) we have performed cesarean section 8 times. The lengths of the anteroposterior and transverse diameters of the superior strait in these cases should be interesting and follow:

Antero-posterior Diameter, Cm.	Transverse Diameter, Cm.	Pelvis
	White Women	
1. 10.25	10.5	Small mesatipellic type
2. 10.25	11.5	Average brachypellic type (borderline-small)
3. 9.00	11.25	Small brachypellic type
4. 9.00	12.5	Platypellic type
5. 9.00	12.75	Platypellic type
6. 8.00	13.5	Platypellic type
	Colored Women	
1. 10.5	10.25	Small dolichopellic type
2. 9.75	10.5	Small dolichopellic type

The incidence of pelvic variations in the group is also of interest.

It will be seen that almost one-half of the pelves in the series were of the mesatipellic or round type while the so-called "normal" of many of our textbooks (brachypellic) occurred in about one-third of the group. The low incidence of the latter type has led me to assume that Nature's pelvis is essentially round and not oval, a subject which I have discussed in a recent article entitled "What is a Normal Pelvis?"[11]

	No.	Per Cent
White women, 334		
Dolichopellic	56	16.7
Mesatipellic	150	44.9
Brachypellic	116	34.4
Platypellic	12	3.6
Colored women, 37		
Dolichopellic	10	27.0
Mesatipellic	18	48.6
Brachypellic	8	21.6
Platypellic	1	2.7

Space permits but a short discussion of some of the influences of these pelvic variations upon the character of the labor. The frequency with which the dolichopellic type is associated with occiput posterior seems well established. It should be emphasized also that the delivery of the aftercoming head through the dolichopellic pelvis should be so conducted that the long diameter of the head will be in coincidence with the long diameter of the pelvic inlet.

In the mesatipellic and brachypellic types the head often enters the superior strait with the occipitofrontal diameter parallel to the transverse diameter of the superior strait, the L.O.T. or R.O.T. position, although in the pronounced brachypellic type the promotory of the sacrum may force the occiput to occupy a posterior position at the beginning of labor. The platypellic type is generally associated with rachitic changes in the sacrum and a lateral view will usually disclose these changes. From these statements it will be seen that a recognition of these types is of importance for the intelligent conduct of labor.

CONCLUSIONS

We believe that the rountine use in primiparae of the outlined procedures makes the conduct of labor in those patients a more satisfactory and safer procedure, and we are convinced that roentgenometry

of the pelvis will eventually form a part of the routine procedure in every well conducted prenatal clinic.

The statistics quoted in this paper are from a study made possible through the Research Funds of Yale University School of Medicine.

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OCCIPITOPOSTERIOR POSITIONS*

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THE great interest in this complication of everyone engaged in practicing obstetrics is more than sufficient justification for again presenting the subject. In addition it is desired to call attention to a phase of the treatment which seems to have been somewhat neglected in recent years, namely the delivery of certain of these cases without rotation. The modern textbooks on obstetrics consider the treatment of occipitoposterior positions in great detail, and the majority are in accord that one hoped for a spontaneous rotation. Failing this and with an arrest of labor so that interference is indicated, manual rotation followed by forceps extraction, or in some instances spontaneous delivery, is considered the best way to treat the condition. Unfortunately in a fairly large percentage of these cases, manual rotation is impossible, or, if accomplished, is only temporary, the head reverting to its former position. It is in the management of these cases that a difference of opinion is noted although most of the writers agree that the Scanzoni operation is the procedure of choice. Williams[1] in his last textbook of Obstetrics, states on page 494 that "The double application of forceps . . . has given such excellent results in my hands that I employ it to the exclusion of all other methods whenever the occiput cannot be rotated manually from its obliquely posterior position." Davis[2] in his compendium of Obstetrics and Gynecology on page 19, Vol. 2 quotes Bill as follows: "Bill believes that in the forceps delivery of an occipitoposterior position the best results are obtained by first correcting the abnormality of position by rotating the head with the forceps to an anterior position at the pelvic plane in which it lies, and without traction. The forceps delivery should not be attempted until a normal position has been obtained." DeLee,[3] on the other hand, in his text book of Obstetrics says on page 1063 "Scanzoni-Fritsch operation . . . is entirely dispensable, and, in my opinion, is fraught with too great dangers to the maternal soft parts and with too much risk of Erb's paralysis to be practiced by any but experts . . . we have better means of correcting occiput posterior positions." In place of the Scanzoni operation he recommends manual rotation, holding the head in position with the forceps on the scalp if necessary, and should this fail a forceps application and maneuver which he describes as the "key in lock maneuver."

In addition to these the recent literature contains several articles on occipitoposterior presentation, most of which include the authors' views on the proper conduct of these cases. The outstanding exception to the latter is Thoms'[4] valuable and timely contribution, pointing out the connection between the condition and transverse contractions of the pelvis, a fact which seems to have been somewhat overlooked.

McQueen[5] recommends manual rotation whenever intervention becomes necessary. Scott[6] reports an incidence of 14.04 per cent for occipitoposterior position in 1000 consecutive cases and treats his cases by manual rotation with an occasional Scanzoni operation. Danforth's[7] experience was that he encountered 285 or 25.20 per cent occipitoposteriors in 1131 cases, and recommended manual rotation and forceps, or version and extraction. Speidel[8] and Reddoch[9] both feel that the Scanzoni operation

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is the best way to treat the complication and Bell[10] contents himself with the statement that "artificial rotation is often necessary." Cosgrove[11] treats those cases in which spontaneous rotation does not occur by manual rotation with forceps delivery or by forceps rotation, and finds himself using the Kielland forceps more and more frequently. Finally, Davis[2] says, "When the occiput is low in a posterior position, it is usually safer to deliver it as such."

It is interesting that this is the only statement in the recent literature advising this method of treatment or even admitting of its possibility, and it was because of this apparent lack that it was thought worthwhile to report our results in occipitoposterior positions. It appeared that in many of these cases extremely poor obstetrics was being done, when the head was grasped with the forceps and forcibly rotated from a position to which it had adapted itself by a slow, gradual molding, and was immediately extracted by strong traction. Our opinion seems to be confirmed by DeLee[3] and Williams.[1] The former says that "The Scanzoni method is likely to twist the vagina from its attachments to the bases of the broad ligaments and to the pelvic floor," and that there is extreme molding of the head when the occiput is posterior; when well flexed it "is that of extreme dolichocephaly," and when partially extended "the shape of the head resembles more that of the brow presentation."

If these statements are true, and all available evidence seems to support them, it would appear that the Scanzoni operation in many cases will subject both the mother and child to a great deal of unnecessary risk. If there are to be severe lacerations of the birth canal, some of which are beyond reach of repair, and if the existing extensive molding of the head is to be disturbed in order that it may be rapidly remolded in another direction and to another shape, certainly the procedure is far from the modern concept of good obstetrical surgery.

TABLE I

Type of Delivery	Spontaneous Rotation with Spontaneous Delivery or Low Forceps	Manual Rotation and Forceps	Scanzoni Forceps	Forceps without Rotation	Total	
Number of cases	206 or 42%	157 or 32%	39 or 8%	88 or 18%	490 or 100%	12.65% of 4187 cases
Primiparae	62 or 30%	81 or 51.6%	24 or 62%	61 or 69%	228 or 46.5%	
Multiparae	144 or 70%	76 or 48.4%	15 or 38%	27 or 31%	262 or 53.5%	
Maternal mortality	0	1 (embolus)	0	0	1 or 0.2 %	
Maternal morbidity	15 or 7.28%	34 or 21.6%	9 or 23.7%	17 or 19.6%	75 or 15.3%	
Total fetal mortality	10 or 4.9%	9 or 5.7%	7 or 18.4%	8 or 9.3%	34 or 6.9%	
Fetal mortality probably due to position or operation	4 or 1.9%	3 or 1.9%	4 or 10.3%	3 or 3.4%	14 or 2.8%	
Fetal morbidity probably due to position or operation	0	4 or 2.5%	4 or 10.3%	8 or 9.3%	16 or 3.2%	

Several years ago we began to divide our cases of occipitoposterior presentations into several groups and to treat each case on its own merits (Table 1). Those which undergo a spontaneous anterior rotation, of course, have no interference unless some indication for assistance arises. The next group shows a prolongation of labor and some exhaustion, and upon examination it is found that an easy manual rotation can be done followed in a minor percentage by spontaneous delivery, and in a major by a fairly simple forceps. These cases must be carefully selected, and, more

important, the manual rotation must be most carefully done, there being a great danger of the head being dislodged and the cord prolapsing. If this accident occurs, the operator feels compelled to empty the uterus at once and usually selects internal podalic version and extraction as the method. That this is a most dangerous operation is proved adequately by the many reports of rupture of the uterus in these cases. The third group is comprised of those cases demanding assistance while the head is still in midpelvis and manual rotation has been unsuccessfully attempted. An example of this is the "deep transverse arrest" encountered rather frequently. The Scanzoni operation is the procedure used in these cases, with insistance upon great care and gentleness, and the operation delegated to an operator of known ability. The last group which is fairly large, comprises those patients in whom, after several hours of labor the head is found very low in the pelvis or practically on the perineum and with the occiput rotated posteriorly into the hollow of the sacrum. Almost without exception in these cases it is found that a great amount of molding and adaptation of the head has occurred, accompanied by an extension to a greater or lesser degree. We believe that if a rotation of the head anteriorly is attempted or accomplished in these cases, two very serious consequences will result; (1) the vagina will suffer a serious and irreparable damage which the most skillful operator is powerless to prevent and which can merely be minimized by episiotomy, and (2) the baby will be gravely and frequently fatally injured. Much easier for both mother and child is the delivery of the head with the occiput remaining posterior, without trying to rotate it to an anterior position. It is not necessary to "guess" in which direction rotation should be done, and everyone admits that even with the most skilful this must often be a guess; the vagina is spared and the fetal head is not the object of dangerous or possibly fatal compression. It is, of course, recognized that the perineum is subjected to greater strain and is more apt to suffer deep lacerations when this mechanism is followed, but when this fact is accepted and the laceration anticipated by adequate episiotomy and afterward followed by repair, the results are eminently satisfactory. The procedure is much better surgery in that it necessitates less traumatization of tissues, and in our hands has been followed by a much smoother and less complicated puerperium. The most marked point of difference, however, is in the final results, these patients presenting six months to one year later a birth canal more closely resembling that of the pregravid state and a general condition of well being so often lacking in women who have gone through a difficult Scanzoni operation, resulting in a markedly lacerated and relaxed vagina and vaginal vault. In addition to this there is a decided decrease in fetal mortality and morbidity, which can only be accounted for by the fact that there is no interference with the existing head molding.

DISCUSSION

There are presented 490 cases of occipitoposterior positions, occurring in a series of 4187 cases, an incidence of 12.65 per cent. It is more than likely that this figure is too small and that there were other cases in which anterior rotation happened spontaneously and the original position was not recognized. In 42 per cent of these cases, spontaneous anterior rotation occurred followed by spontaneous delivery or a simple forceps operation. Fetal mortality was 10, or 4.9 per cent, of which 4, or 1.9 per cent, could be attributed to the position or operation. The criterion for determining the latter fact in all instances was evidence of cranial injury or hemorrhage, in many cases confirmed by autopsy findings. Thirty-two per cent could be rotated manually to an anterior position and some of these delivered spontaneously, although the majority required assistance with forceps, accompanied in some instances by episiotomy. Here the fetal mortality again was comparatively low, 5.7 per

cent, and that part apparently due to the position or operation the same as in the first group, 1.9 per cent. The maternal mortality in this group, was in our opinion, purely an accident of labor and was not in any way attributable to either the position or any operation.

In the third group, comprising 8 per cent of the total, the Scanzoni operation was considered necessary and was done. It was in this group that our poorest results were obtained, a fact not very well demonstrated by the accompanying table, for while we find a total fetal mortality rate of 18.4 per cent and one due to position or operation of 10.3 per cent and a maternal morbidity of 23.7 per cent, none of these figures give a true picture of conditions as they presented themselves. It is most distressing to think of the birth canal of many of these women after delivery, and while in practically all of these cases, the particular operation seemed to be the necessary one, the final impression gained in retrospect is that it is far from satisfactory. There seems nothing to be offered in substitution; a routine version and extraction in these cases would certainly have given much poorer results, and probably the most valuable lesson to be learned is to so conduct our cases that the resort to operation will be necessary less and less frequently.

It is to the fourth and last group that we desire to call particular attention, this is 18 per cent of the total and includes those cases in which the occiput had rotated directly posterior. Many of these had been in labor for a long time when first admitted to the hospital and presented the expected complications of maternal exhaustion and fetal distress. In spite of this we find a total fetal mortality of only 9.3 per cent, and an assignable one of 3.4 per cent, about one-half of that of the group delivered by the Scanzoni operation, a fact, as we have said before, which we feel sure to be due mainly to the non-interference with the existing head molding. The final results from the maternal standpoint were also much happier in this group, and one looks back upon them with a certain feeling of satisfaction so often and so sadly missing in the practice of Obstetrics.

CONCLUSION

It would appear, therefore, from the rather small number of cases, that the Scanzoni operation is not all that is claimed for it by many writers. It was, in our hands, accompanied by a decided increase in fetal mortality and morbidity, and maternal damage. There is a certain percentage of occipitoposterior positions in which no other operation or method of delivery would probably give any better results, but if cases are carefully watched and supervised the necessity for resorting to it will become decidedly less. When the head has rotated directly posterior, a much happier outcome can be anticipated if no attempt at rotation is made, but delivery completed after episiotomy, when indicated, with the occiput remaining posterior.

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MANAGEMENT OF TRANSVERSE PRESENTATION

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THE incidence of the abnormal transverse presentation is generally assumed to be about one-half of one per cent. Actually, as observed in practice, this figure is probably high, especially if those cases in which pregnancy terminates itself early are excluded. In the latter the mechanism involved presents no special problem.

Transverse presentation, in spite of its comparative infrequency at term, is important, however, for when encountered it always presents a serious delivery problem. Most commonly in a transverse the shoulder or scapula is the actual presenting part, the head occupying the right or left iliac fossa. An arm in the dilating cervix is frequently found with shoulder presentations.

The etiology of this abnormal presentation is important because the management of the individual case is largely dependent on its cause. The presentation is perhaps most commonly encountered in the multipara who has had numerous children, whose previous deliveries have been rapid and uneventful. The etiological factor in this group is obviously an extreme abdominal wall relaxation with marked prolapse of the fundus forward and a consequent disturbance of the relationship of the presenting part and the pelvic inlet. A large pelvis favors the condition.

A second group is that in which the presentation accompanies the more extreme degrees of bony deformity, of the pelvis itself, of the superimposed skeletal structure or both combined, with marked changes in size and shape of the inlet. Lordosis, the rachitic dwarf, Pott's disease of the lower spine, Naegele's pelvis, osteomalacia, are representative types of this osseous pathology. Occasionally a transverse presentation may be associated with the more common symmetrical contractions of the brim.

A third group is that of pregnancy complicated by neoplasams. A sizable fibroid in the lower uterine segment may easily occupy a position in the inlet occupied normally by the presenting head, though a breech presentation in such cases is common. An ovarian cyst of relatively large size obviously may cause an abnormal lie of the fetus.

Polyhydramnion, fetal monstrosities,and anasarca neonatorium, represent types of obstetric pathology which may be further complicated by a transverse presentation.

Every obstetric patient should at each pregnancy visit to the physician be examined abdominally, one object of which is to secure an accurate knowledge of position and presentation before labor begins. In the majority of cases, palpation alone is sufficient to obtain this accurate knowledge. Abdominal palpation may be unsatisfactory because of extremely fat abdominal walls, or to overdistention of the uterus, in turn due to the size of the fetus or excessive fluid. Inability to palpate fetal outlines satisfactorily, in the presence of overdistention always of course will raise a question of multiple pregnancy.

If in a given case a diagnosis of position and presentation by abdominal palpation is impossible or unsatisfactory, especially if skeletal anomalies are present, an *x*-ray study of the pelvis is imperative. In a primipara, a transverse lie must always be assumed to indicate definite coincident pathology, until proved otherwise.

In the care of multipara with extreme abdominal relaxation, prophylaxis is important. The tendency to a transverse presentation may be overcome by the use of proper abdominal support during late pregnancy which will also minimize the abdominal discomfort so commonly associated with this extreme relaxation.

Fig. 1. Typical transverse presentation in a multipara with relaxed abdominal walls. Note the large pelvis.

When a transverse presentation, in a multipara with extreme relaxation, is discovered before the onset of labor, the condition can often be corrected without difficulty by external cephalic version. The subsequent use of an adequate abdominal support will help to keep the head in normal relationship to the inlet. This support should be worn continuously, in the form of a binder at night.

When in a multipara the transverse presentation is not diagnosed until after the onset of labor, procedure very definitely depends on whether or not the membranes have ruptured at the time of its discovery.

Before rupture, and early in labor, the position may be corrected by external cephalic version followed by a many tailed abdominal binder firmly applied and tightened from time to time. If the external version maneuver is unsuccessful, the binder alone may suffice, as labor progresses, to correct the presentation. If the head (or breech) engages labor may be allowed to terminate spontaneously. If, when the cervix is effaced, the presentation has not become corrected the patient should be delivered by version and breech extraction. If the cervix does not satisfactorily efface itself after a reasonable labor, or if labor becomes inadequate before effacement has occurred, manual completion of the dilatation of the cervix may be attempted to be followed by version and extraction provided always, that the lower segment is well thinned out and stretches easily. On the other hand, a patient with a thick cervix with a small amount of dilatation is more safely delivered by low cesarean section. The decision in such a case will have to depend on obstetric judgment.

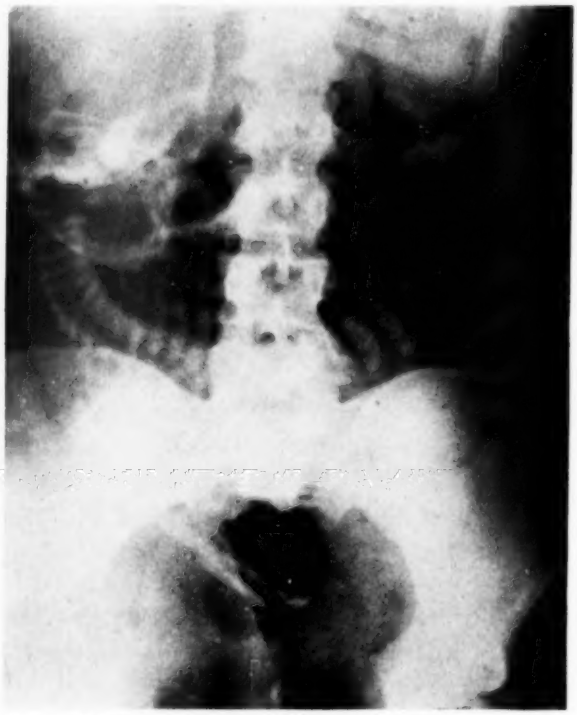

Fig. 2. Transverse presentation, right arm presenting.

In a general way expectant treatment is justified before rupture of the membranes, for in a definite number of these cases the position will correct itself spontaneously as labor advances. The case must however, be observed continuously and one must be in readiness for immediate delivery when the

membranes rupture. A prolapsed cord accompanying rupture of the membranes is a common and serious complication of this presentation.

Expectant treatment in the case with ruptured membranes, on the other hand is absolutely contraindicated. Immediate delivery is indicated. The method will depend on the conditions present. If the cervix is dilated or easily dilatable, if the uterus relaxes normally between contractions, if the presenting part can be displaced easily and intrauterine manipulation continued without undue difficulty, version and extraction is the correct procedure. If all or any, of these requirements are absent, the low cesarean is a safer procedure. A very real danger of attempted version in the so-called neglected transverse presentation is rupture of the uterus. With a dead or macerated fetus embryotomy, provided instruments and experience are available, is the procedure of choice, especially in prematurity.

A transverse presentation accompanying gross anomalies of the bony pelvis is an absolute indication for cesarean section. This is preferably performed at or near term without waiting for the onset of labor.

In that group in which a transverse presentation is found associated with or resulting from new growths, especially fibroids projecting into the inlet of the pelvis, cesarean section is indicated, with a Porro, possibly a myomectomy to follow. One is very rarely justified in these cases in experimenting with a difficult delivery with its probability of severe postpartum hemorrhage, and necrotic changes in the puerperium likely to follow.

SUMMARY

To summarize the most important aspects of the management of the transverse presentation; the multipara with unruptured membranes who has had previous normal deliveries, can ordinarily safely be allowed to continue in labor, to be delivered by version and breech extraction as soon as the cervix is effaced, or is easily dilatable. In the absence of complete dilatation, in the presence of a rigid uterus, in the so-called neglected case, low cesarean section is the wiser treatment. The importance of prophylactic abdominal support during pregnancy is emphasized.

Transverse presentation in the patient with marked pelvic deformity is an absolute indication for cesarean section.

Transverse presentation associated with, or resulting from new growths, especially fibroids, more or less blocking the pelvic inlet, is also an indication for cesarean section, to be followed usually by a Porro, occasionally by a myomectomy.

In general, the cases promising an easy version and extraction should be managed by that procedure. In all others excepting that with a dead fetus, early resort to low cesarean section will usually represent good obstetric judgment.

MANAGEMENT OF BREECH*

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STATISTICAL reports of breech deliveries place a high fetal mortality on this presentation. This fact may be partially accounted for by the large number of premature, dead and macerated babies which present by the breech. Undoubtedly, many normal babies are lost because of this presentation. Some practical points in the technique of the management of breech presentations will be detailed in the hope that they may be of value.

The ideal management of this presentation is to convert the presenting breech into a presenting vertex by external manipulation. The maneuver should be performed late in pregnancy or, preferably, at the onset of labor. It is unfortunate that the primiparous patient with a presenting breech, the most important to convert by external version, offers the greatest difficulty. This is due to the tightness of the abdominal wall, the rigidity and irritability of the uterus, and engagement of the breech in the pelvic brim in many instances. In multiparous patients having this presentation the breech should be converted whenever possible. If external version is impossible the labor must be conducted with the breech presenting.

The operation of cesarean section has no place in the management of the normal breech. It should not be considered unless there is a concomitant pelvic obstruction or deformity, but it may be justified for the occasional borderline pelvis, especially if the baby is large.

MANAGEMENT OF THE FIRST STAGE OF LABOR

The first stage of labor is likely to be longer than when a vertex presents and management should be initiated by placing the patient in bed immediately. This may prevent the premature rupture of the membranes. The usual sedatives may be given if the labor seems to be progressing normally. The ideal outcome of this stage is to have a large bag of forewaters develop and remain intact until the cervical canal is completely effaced and dilated, at which time the breech is usually found to be well engaged in the pelvic cavity. Often the membranes rupture spontaneously before labor or shortly after the onset of the pains. If this should occur and on examination the cervix is found to be soft, elastic and not too thick, the buttocks of the baby will often dilate the cervix almost as readily as a bag of forewaters and there will be little or no delay in the progress of labor. If, on the other hand, an examination reveals the cervix to be thick, rigid, and only slightly dilated, I have found the use of the hydrostatic bag to be of value. It should be promptly introduced within the cervical canal. Good pains usually begin soon afterward, the dilatation of the cervix occurs more rapidly, thereby shortening the first stage of labor. For a normal or large size baby I prefer the Voorhees number five, the number four may be used if the dilatation does not permit the larger one. There is little danger of an infection following this procedure if the bag is introduced promptly under good surgical technique; in fact, by shortening the first stage the use of the bag may act as a prophylactic measure. By conserving her strength the patient will be better able to utilize the pains of the second stage.

* From the Department of Obstetrics and Gynecology, Cornell University Medical College and the New York Hospital. Read at the Section Meeting of Obstetrics and Gynecology, New York Academy of Medicine, January 26, 1937.

If the breech becomes impacted in the pelvic cavity with the membranes ruptured and the cervix incompletely dilated, surgically prepared and draped, the operator should have a competent assistant, forceps should be on the instrument table,

Fig. 1. Delivery of anterior shoulder. (Enlargement made from moving pictures taken of actual delivery.)

some operators "break up" the breech and draw one or both legs of the baby into the cervical opening. This may be performed by introducing the hand into the uterus and doing Pinard's maneuver on the baby's thigh, then the foot is grasped and drawn downward through the cervical opening. Those who advocate this procedure claim that pains are increased and the labor enhanced. I have had no experience with this method.

MANAGEMENT OF THE SECOND STAGE OF LABOR

During the second stage the patient should be encouraged to cooperate with the pains to the utmost of her ability. The breech should be forced down to the perineum and, if possible through the orifice, until the umbilicus of the baby or the angle of the scapula appears under the symphysis. When the breech is visible at the orifice of the vagina preparation should be made for the delivery. The woman should be and the infant resuscitation apparatus should be available. It is always well to remember that a seemingly simple breech delivery may prove very difficult.

If the parturient can express the baby until the umbilicus, or better until the angle of the anterior lying scapula appears, that is all that should be expected of her. Deep general anesthesia should then be induced.

The lower extremities, if they have not dropped out of the vagina spontaneously, should be gently withdrawn by abducting the thighs and flexing the legs. The baby should be covered with a warm wet towel and by gently lowering the body the anterior arm will be found just inside the vagina and under the symphysis. This can easily be extracted by placing two fingers of the hand into the vagina and withdrawing this extremity, the baby's body should then be lifted slightly, two fingers introduced posteriorly and the posterior lying upper extremity withdrawn in exactly the

same manner. No traction, rotation or "corkscrewing" of the baby's body is necessary and there should be no pressure on the fundus of the uterus at this time. Following the delivery of the upper extremities, the baby's body should be placed astride of the operator's forearm and one finger of the same hand placed in the baby's mouth. From habit I always use my middle finger. No traction should ever be made with this finger beyond the amount needed to secure flexion of the head and to hold it flexed. The operator, who should be sitting until this time, now stands, and with the free external hand pushes the baby's head from above the symphysis into the pelvic cavity. If the woman is a primipara, as soon as the baby's head passes into the pelvic cavity the operator should have the assistant take the baby's body and elevate it slightly but not enough to sharply angulate the neck and to cause cervical injury. The surgeon is then free to apply forceps to the aftercoming head of the baby. The forceps is slightly difficult to apply because the application is from chin to occiput instead of the reverse, as is the usual method. With a little practice this difficulty is easily overcome. After the forceps is applied and carefully locked, traction should be made downward until the baby's chin appears under the symphysis, then the handles of the forceps should be elevated and the head flexed through the outlet.

FIG. 2. Delivery of posterior shoulder. (Enlargement made from moving pictures taken of actual delivery.)

It is not necessary to apply forceps to the aftercoming head of the baby in many parturients, especially in multiparous women or for small babies in primiparae. After the head has been forced into the pelvis slight traction downward on the baby's shoulders followed by a slight upward pull on the baby will allow the head to escape readily. If there is any resistance forceps is preferable as it obviates all danger of separation and fracture of the cervical vertebra.

The late Dr. E. L. Piper, of Philadelphia, designed a special forceps for the aftercoming head. It is a very useful instrument. If, however, the operator has a forceps with which he is thoroughly familiar, it will be just as easy or easier to use. All internes or beginners in the practice of obstetrics can profitably practice breech delivery on the obstetric manikin.

It has become almost a routine to perform an episiotomy for the delivery of a breech in a primipara. I prefer the mediolateral type on the left side of the patient. An episiotomy is not absolutely necessary as many breech deliveries have been accomplished with no perineal tear or only a slight one, especially if the baby is small.

Fig. 3. Forceps applied to aftercoming head. (Enlargement made from moving pictures taken of actual delivery.)

BREECH EXTRACTION

Breech extraction is nearly always a formidable operation. If for any reason a patient in normal labor cannot push the breech down to and through the introitus, the extraction will be difficult. This does not apply to breech extraction following an internal podalic version but to an extraction when secondary inertia, from any cause, is the reason for the failure to deliver. Breech extraction should never be attempted until the cervix is fully dilated and the patient has been given every opportunity to expel the child. Sometimes it becomes necessary for a failing fetal heart.

TECHNIQUE OF BREECH EXTRACTION

After all the necessary preparations have been made, the perineum should be "ironed out" and, if necessary, an episiotomy performed. The legs of the baby should then be brought down if they are extended. Pinard's maneuver is then used to flex them. If only one leg can be grasped the anterior is preferable. Traction should then be made on the leg, or legs, thighs and baby's body as it appears through the vulva. This order should be followed rather than making all of the traction on the baby's feet, thereby causing tension on all of the joints of the lower extremities and the spine. The operator should "follow through" by taking a higher and higher grasp of the baby. A warm towel will facilitate grasping the baby's body. The direction of traction is most essential, it should be almost vertical—"toward the floor." As the umbilicus appears a loop of the cord should be extracted. If the upper extremities remain flexed across the chest in the normal attitude they should be delivered exactly as described for breech delivery; but if there is resistance from a tight lower uterine segment or the pelvic canal, extension of one or both of the extremities will take place. If this should occur extraction of the arms will become more difficult and

the posterior lying extremity will have to be delivered first. This is accomplished by grasping the baby's feet with one hand and gently flexing the body upward and away from the posterior shoulder. The operator's hand, the palm of which faces the baby's back, is now introduced into the pelvis until the index and middle fingers are alongside of the extended arm. These two fingers now act as a splint, and are gently pushed forward until the baby's arm crosses the face, when the middle finger can be hooked into the elbow drawing the arm into the pelvic cavity.

At this stage of the extraction the posterior shoulder must be rotated to an anterior position. This can be easily done by keeping the two fingers, used previously to draw the posterior arm into the pelvic cavity, on the anterior chest wall of the baby in the region of the clavicle. The outside free hand of the operator is then placed against the scapula of the baby lying under the symphysis. A rotatory motion is applied to the body of the baby and the anterior shoulder assumes a posterior position. The second shoulder is now released in exactly the same manner except that the surgeon's hands are reversed. This is usually very simple as the wedge has been broken when the first arm is drawn down. The aftercoming head is now delivered as has been described.

The third stage of labor should now be conducted as after any other delivery. Tears in the cervix, if suspected, should be visualized and repaired. Perineal tears or the episiotomy wound should be sutured and the placenta delivered normally.

IMPORTANT POINTS

It is much better for the operator to sit on a stool during a breech delivery, except momentarily when he should stand to push the head into the pelvic cavity.

The feet of the baby should not be used as a traction bar. "Follow through," grasping successively the legs, thighs, and body. A warm wet towel will facilitate a grip on the body. Remember that the baby is a delicate human mechanism.

Take the shoulders out simply, not by corkscrewing the body as there is danger of damaging the liver and the adrenal glands.

Forceps applied to the aftercoming head, after it has entered the pelvic cavity, will eliminate the danger of injury to the cervical vertebras.

SUMMARY

The ideal method of the management of a breech presentation is to convert the presenting breech into a vertex by external manipulation whenever this is possible. Cesarean section has no place in the management of this presentation unless there is some other indication. Conservative management of the first stage of labor is most essential. Be prepared for difficulties at the actual delivery of a breech. Deliver the baby with as little manipulation as is possible. Forceps applied to the aftercoming head is advantageous, especially in the primipara. Breech extraction is nearly always difficult and should not be attempted unless there is an absolute indication.

JUSTIFIABLE USE OF THE OBSTETRICAL FORCEPS*

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EVER since the days when Smellie[1] surreptitiously concealed his forceps in his side pockets and slid them into place beneath the bed covers, the obstetrician has depended more often upon the aid of these instruments to solve an obstetrical impasse than any other maneuver in the practice of his art.

The need for forceps delivery may be absolute or relative, however in this country there is coming to be too wide a spread between the absolute indications and the wise use of the instrument. Every tyro can be taught reasonably well how to apply forceps, but the young practitioner who has attained a certain amount of confidence and skill in the use of the instrument must beware lest this lead him to a too frequent and unnecessary use of it. There should be better reason for the modern control and prophylactic forceps than the sole question of time or the obstetrician's convenience; nor should exhaustion nor distress on the part of the patient, the family or himself be permitted to influence his good judgment in not interfering with the normal progress of labor.

It is a question whether many of these "convenience forceps" are not rather unnecessary. Perhaps in a hospital where the technique is beyond reproach, where the facilities are adequate, the obstetrician experienced and the assistance entirely dependable, a perineal forceps will not injure the child nor increase the mother's morbidity; but under any other circumstances it is wiser to use a little more time. Many low forceps could be avoided by properly working with the patient as the head passes the bony outlet. By encouraging her at each contraction, with her thighs pressed closely upon the abdomen, partly to enlarge the pelvic outlet and partly to brace the abdominal muscles, sometimes aiding a bit with fundal pressure, it is often possible to effect delivery where the bearing down pains have not been quite sufficient.

The incidence of forceps deliveries reported by Plass[2] three years ago at the White House Conference in a combined hospital series of 145,812 deliveries was 17.9 per cent. The New York Lying-In Hospital figures in 180,000 confinements were not included in this report, to my knowledge. Our forceps incidence from 1928 to 1932 ran a fraction over 9 per cent. As pointed out by Plass it varies greatly in different clinics. The most noticeable variation is that between the ward and private service in the same hospital. Since 1932 the ward incidence at the Lying-In Hospital in 8828 indoor deliveries has been 10.6 per cent, whereas in 1808 private patient deliveries it has been 26.7 per cent.

As the course of labor is followed, occasions do arise when even with good contractions, the efforts of the patient fail to accomplish delivery, and it appears necessary to assist with forceps or some alternative. The physician's ability to recognize such failure will depend largely upon his familiarity with the phenomena of normal labor, for there is no situation or operation in obstetrics where a sound knowledge of

[1] SMELLIE, W. Treatise of Midwifery. London, 1766.

[2] PLASS, E. D. White House Conference Rep., 1933.

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the mechanism of labor in all its details is so important.

The most common indication for forceps is a failure of expulsive efficiency, either uterine, abdominal or both, in overcoming the resistance of the birth canal. Whether the resistance comes from disproportion or from malposition first must be determined. Uterine inertia in the second stage of labor may be an indication for the use of forceps, but it must be remembered that if the head is arrested high in the pelvis, inertia is rarely the real cause of the delay. With the head through the pelvic brim the expulsive efficiency may fail because the strength of the patient has been used up during the first stage of labor in dilating a rigid cervix, so that there is little left for accomplishing the second. Again strength that should have been adequate for delivery of an anterior position may have been spent in futile attempts to rotate a persistently posterior position of the occiput.

There are three primary factors, all interrelated, in a prolonged labor; uterine inertia, delayed cervical dilatation and disproportion. Besides these there are two secondary dependent factors: deflexion and failure of rotation. It is up to the obstetrician's experienced judgment to decide which is the predominant factor and to direct his treatment accordingly. Decision frequently demands a carefully conducted sterile vaginal examination. The dilatation, texture, dilatability and thickness of the cervix must be investigated.

The Kerr-Muller impression test in estimating disporportion is an important one. The final determination may require a thorough manual exploration of the pelvic cavity under anesthesia with a repeated trial of the Kerr-Muller impression and an accurate check-up of the length and of the diagonal conjugate. Prolonged moulding is necessary in many instances, and may secure an unaided delivery that otherwise would have appeared impossible. This moulding takes time. Consideration of this fact should be kept in mind when watching a case of tedious labor.

A second group of indications for forceps delivery will be found in situations where progress of the presenting part is sufficiently normal, but not sufficiently normal for the case in hand, such as in eclampsia, cardiac disease and acute pulmonary conditions on the part of the mother; and on the part of the child when there is evidence of dangerous pressure, such as a hard tense caput, recent passage of meconium, or marked change of fetal heart rate. In these situations forceps may often be indicated and justified in order to shorten the usual duration of the second stage. It is in such contingencies, especially in nulliparous perineums, that preliminary episiotomy is so valuable.

Change of fetal heart rate as a sign of fetal distress necessitating hurried delivery with forceps has become a somewhat abused indication. There is accumulating evidence to show that it is not entirely pathognomonic of impending asphyxia. It is not an unusual experience to lose a fetal heart suddenly that has been at a rate of 130 to 140 and the baby die without warning. On the other hand during the first stage the fetal heart may drop to 110–114 for several hours, and yet at birth hours later the baby be in good shape with no sign of asphyxia. A fetal heart dropping in the perineal stage to 80 per minute right after a contraction and which returns to 120 or so between contractions is not necessarily alarming. If the violence of the labor seems to be adversely affecting the fetal heart, such as acceleration to 170–180, a few minutes of ether anesthesia may do more to relieve the pressure on the baby's circulation than immediate instrumental delivery.

When it has been decided that there is imperative need for forceps delivery we are next compelled to submit to the fulfillment of certain conditions:

1. The cervix must be fully dilated. The use of forceps is primarily an operation restricted to the second stage of labor. It is bad practice to attempt to dilate an incompletely dilated cervix by pulling the

head through it with forceps. There seems to be an immediate tendency for the cervix to contract with the pull. Serious lacerations may ensue, as well as increase of dangerous compression of the head from the leverage of the ring of cervix on the blades. When delivery with forceps is necessary and the cervix is but 4 to 7 cm. in diameter, two or three Dührrsen's radiating incisions should be made with a scissors before attempting application. If only a small remaining rim of cervix is present it should be dilated digitally.

2. Disproportion between the head and the pelvis must not be too great. This applies to brim, lateral walls and outlet.

3. Such malpositions as may be present must be corrected. Many attempted forceps fail because of an unrecognized deflexion or posterior position.

4. The head should be engaged in or through the brim of the pelvis. In proportion as the vertex is arrested high in the pelvis, in the brim or above the brim, the necessity, the utility and the safety of forceps delivery becomes more debatable.

We speak of low forceps, midplane forceps and high forceps application, with relation to the station of the head in the pelvis. Many so-called low forceps are in reality midpelvic forceps, many midpelvic forceps turn out to be high forceps. The definition depends considerably upon the obstetrician's experience.

High forceps in the usual sense of the term is understood to mean application of the instrument to the fetal head when its largest diameters are just above or in the plane of the pelvic inlet. It is the fashion to mention and to condemn high forceps in the same breath, and in general such criticism is sound. With the head in or above the brim, conditions otherwise proper and indications present for delivery, version competes with high forceps, with preference in most obstetrician's minds for version. However there are some situations when in my opinion high forceps is not only justifiable but preferable.

I agree with Kellogg[3] that high forceps is not an obsolete operation but has a definite, if narrow field. One is a tight uterus in a multipara with normal pelvis, and another is a pelvis slightly flattened at the brim. With a tonic uterus it is too late for version for fear of rupture. One or two moderate pulls with the axis-traction instrument will often bring the head into the pelvis. Ideally there should be no such thing as a hard high forceps in the sense of hard traction. The operation may well be difficult, but the difficulty is one to be overcome by skill and dexterity, not by pulling.

In a pelvis moderately flattened at the brim and one or two tractions fail to dislodge the head, one should not fail to put the patient in the Walcher position, buttocks at the end of the table, legs dropped almost perpendicularly, and the operator sitting on the floor between them. An extra 0.5 to 1 cm. is immediately gained in the length of the true conjugate by this position of the patient.

High forceps should be chosen only when the head is well moulded, when there is but little overlapping with the moulding, and when success in engaging the head through the brim attends one or two moderate tractions of the forceps, sometimes aided with the Walcher position.

In all forceps applications a cephalic lie should be the objective and great gentleness must be observed. The ability to apply them under very light anesthesia would be a good index of an operator's skill. In the preanesthesia era a man had to be exceedingly gentle lest the patient remonstrate too much. Dexterous operators claimed they could apply without the patient's knowledge and extract with no increase of the patient's suffering. If a blade goes on with difficulty, it is probably not going to result in a good cephalic application and there is likely to be some damage to the soft parts.

[3] Kellogg, F. S. *Jour. Michigan Med. Soc.*, 27: 443–448 (July) 1928.

Traction is best made synchronously with a uterine contraction and should imitate in length and continuity the force of an expulsive contraction. In spontaneous labor the patient who is having a good expulsive pain will pause in the middle to take a breath and push again. Simulate this in your pull and make two parts of it. Do not make any single traction longer than two minutes. When you feel sudden definite progress, that is the time to desist. Pause and begin again with the next contraction. If the contraction is slow in coming gentle kneading of the fundus will start one, or it may be started with the traction itself. When it is necessary to terminate a case of prolonged or difficult labor with forceps, use every precaution of gentleness for the sake of the baby, deep episiotomy and cautious traction. It is a matter of common observation that such babies do not stand forceps well and the fetal mortality rapidly rises. Do not elevate the handles too rapidly at the outlet, nor employ the modified Ritgen maneuver too violently as the head distends the perineum. Both Gammeltoft and Kielland criticized us even in normal delivery for encouraging marked extension of the head as it crowned. They preferred more prolonged maintenance of flexion in avoiding perineal lacerations.

As to choice of instruments, any of the modern standard types, that has not been modified by some enterprising obstetrician, is good. Each proves most reliable to the man who consistently uses it. My personal preference is for the Kielland forceps. Having accustomed myself to its use during the past seven years, I find it especially useful in the more difficult cases. In a simple low forceps operation any instrument will do, but in deep transverse arrest and in persistent posterior occiputs the Kielland instrument is definitely superior. When the uterus is tightly contracted about the baby and the lower uterine zone is stretched thin and tight, or when the pelvis is contracted and the head closely fixed, it is dangerous to introduce the anterior blade by Kielland's classic radical method. It is here he suggests the "gliding method," clock-handwise in a plane tangent to the pelvic outlet, as safer technique. In the ordinary wandering method with the handle held at one point by the external hand, the forceps blade as a whole is made to generate the surface of an acute cone. It will be found impossible by such a maneuver to get the anterior blade deeply up back of the symphysis as is necessary in making a single cephalic application to a transverse or to a posterior position of the head.

Kielland's gliding method differs from the ordinary wandering method as follows: The patient's buttocks are brought well to the end of the table, the thighs held sharply flexed and out of the way. The anterior blade is then correctly chosen and held horizontally almost at right angles to the axis of the pelvic outlet, with the tip at the vulva steadied by the thumb and fingers of one hand, the other hand pressing the handle firmly against the opposite buttock. The blade is then slowly introduced as in the lateral method and the fenestrum lies over the brow or face. The handle externally is kept pressed firmly against the buttocks as it is swept down almost in a plane tangent to the buttocks in a wide one-quarter circle. The thumb of the vaginal hand acts as a fulcrum while the two vaginal fingers both guide the fenestrum up into place and at the same time protect the vaginal walls as the handle externally pressed against the opposite buttock bears the fenestrum away from pressure on the head. As the blade approaches the midline up behind the symphysis, the handle is sharply depressed against the perineum and almost at the same moment the blade definitely ascends as it slips into place. On a transverse head the blade is glided to the median line to assure a perfect cephalic application. On the right or left occiput posterior position the fenestrum is swept on beyond the median line into position. This makes it possible to secure instru-

mental rotation and extraction with a single application, which may be effectively done with the Kielland instrument. The posterior blade is then passed in the ordinary manner. It is necessary to avoid the obstruction caused by the sacral promontory by a little maneuvering. It is much easier to pass the posterior blade of the Kielland forceps correctly into correct cephalic application in R.O.P. or L.O.P. positions than when the sagittal suture is transverse, as the blade is inserted in the posterior half of either oblique diameter to one side of the promontory.

SUMMARY

Having described these few points in technique, especially in regard to the application of the Kielland anterior blade, I would direct attention again to the unnecessary increase in the use of low forceps, and urge that indications be made more strict both in teaching and in practice. Except under most exceptional circumstances true perineal forceps can be avoided by episiotomy combined with fundal pressure, while outlet, midplane and high forceps should always have real indications and favorable conditions.

VERSION*

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VERSION is the term applied to all operative procedures which produce a change in the relationship between the long axis of the fetus and the long axis of the uterus. Depending upon whether the head or the breech is substituted in this way for the original presenting part the operation is known as a cephalic or podalic version respectively. The method by which the version is accomplished also qualifies the operative terminology. Hence, we speak of an external version when the child is turned entirely by external abdominal manipulations. A combined or Braxton Hicks version refers to that type which is effected by a combination of digital manipulation through the partially dilated cervix and external turning of the child through the abdominal wall. An internal version is accomplished largely by use of the entire hand introduced into the uterine cavity with little or no external aid. It is this last type of version that is usually implied when the term version is used unqualifiedly.

To obtain the proper perspective of its field of usefulness it will be profitable for a moment to think about version in conjunction with some of the other operative obstetrical procedures. Version is the oldest of that triad of operations which the obstetrician employs when Nature fails to effect a spontaneous delivery, namely, version, forceps and cesarean section. Although cephalic version was extensively practiced by Hippocrates and, supported by the teaching of Galen, continued in favor until the sixteenth century, it was Ambrose Paré who first clearly described and indicated the possibilities of internal podalic version. Since that time the operation has enjoyed a varying degree of popularity. With the advent of the obstetrical forceps it was learned only by continued experience that these instruments were not particularly adapted for the extraction of the child when the vertex presented high in the pelvis and the waning interest in the version operation at that time was revived to the extent of making it almost a complete substitute for the high forceps operation. At the present time, with the cesarean section incidence constantly mounting, a fall in the incidence of version is again noted. As a result the young obstetrician obtains so little experience in this procedure that very few of them acquire the skill to do a good version. Because they lack this skill, the operation does not suggest itself as a possible method of delivery in a difficult case and this in turn leads to almost complete ignorance of the type of cases which can be most advantageously treated in this way.

Unfortunately, with the rising incidence of cesarean section there is not a comparable decrease in its mortality rate. Since the latter remains very nearly the same it means that the gross mortality increases each year. If the trend continues, therefore, it will be impossible to avoid reaching a saturation point at which the attitude toward cesarean section will become reactionary due to the increasing mortality and a revival of the more typically obstetrical procedures will be in order. For this reason therefore the indications and technique of version must not be forgotten, but must constantly be brought before us.

EXTERNAL CEPHALIC VERSION

External cephalic version as a routine procedure in practically all breech presen-

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tations has many staunch advocates. There is much to commend this type of version when it is realized that the breech mortality rate for the infant is still high, being roughly about 10 per cent, and that those who have adopted this procedure report success in being able to turn from 50 to 90 per cent of their breech presentations. At the Sloane Hospital for Women, external version has been successful in 82 per cent of the cases during the last five years.

It should be part of the antepartum routine to see the patient when she is six or seven weeks from term and at that time to make a careful appraisal of the position. Should the breech present it is advisable to do an external version providing that placenta previa and multiple pregnancy are not suspected. The technique is not difficult. The patient is placed in the Trendelenburg position to facilitate the disengagement of the breech. Anesthesia may be necessary to relax the tone of the abdominal muscles if these become tense but this should not give the operator license to use force under any circumstances. With one hand grasping the breech over the symphysis it is first pushed upward to disengage it; then while this same hand pushes the breech circularly upward, the other hand simultaneously pushes the head downward in the same manner. A clockwise or counterclockwise rotary movement depending upon whether the back is to the right or left respectively, is thus imparted to the child. After the head has been made to settle into the lower segment of the uterus the patient is changed to a semirecumbent position and the head is gently fitted into the superior strait. A supporting girdle with which a pad may be held back of the fetal shoulder will materially aid in preventing the breech presentation from recurring. Since it is difficult to keep a pad in place it is better to sew a pocket on the inside of the girdle in the appropriate location and this can be filled with cotton to act as a pad.

Should the version fail when done in this way the direction of rotation should be reversed. Often the version may not be successful on one occasion but is easily carried out after an interval of two or three days. Failure is most frequently due to the fact that the breech is not pushed up out of the pelvis before the child is actually turned. Another cause of failure is due to the fact that the version is done too late in pregnancy. The optimum time is between the thirty-second and thirty-fourth weeks. Version after this time becomes increasingly difficult. Still another group of failed cases are those in which the legs are extended so that the trunk is splinted by them. This group can be diagnosed by *x*-ray studies.

INTERNAL PODALIC VERSIONS

Indications. The following reports illustrate the types of cases in which version is practiced. These cases have been selected from the 1932–1936 files of the Sloane Hospital for Women.

1. *As a Substitute for the High Forceps Operation.*

S. D., aged thirty-four years, para III, had considerable difficulty with all three of her previous labors. The pelvis was of the small gynecoid variety (generally contracted). After twenty hours of labor she presented the following: No progress for the last three hours although contractions were of good quality; membranes intact; cervix four fingers dilated, soft and dilatable; R.O.T., with the leading part of head above the level of the spines. Barton forceps were applied but resulted in little progress. Marked slowing of the fetal heart followed the forceps attempt. The anesthesia was deepened and a version and breech extraction easily effected the delivery of a 7 lbs. 2 oz. child but neonatal death followed after one-half hour.

This case illustrates a common type of error in choice of operations. Often it is found that a person who is partial to forceps will be tempted to do a high forceps even when version is admittedly a safer operation. The version in this case was so easily accomplished that it can be justifiably argued that had the child not been compromised by the attempted forceps operation it might very well have lived.

2. *Parietal Presentations.*

E. B. white, aged twenty-six years, para 1, presented a gynecoid (normal) pelvis. The head was floating at the onset of labor. After eight hours of good contractions the cervix was found to be three and one-half fingers dilated. The head at this time was still very high. No serious import was attached to the high head because the pelvis was checked during labor by roentgenograms and found to be quite ample. After eleven hours the examination showed the cervix to be completely dilated; vertex, R.O.T., asynclitic, so that the posterior parietal bone was presenting. Version followed by breech extraction was easily done. The baby weighed 7 lbs. 6 oz. and was in good condition.

This is a classical type of case for version. When the head remains asynclitic so that the parietal bone presents even after sufficient labor has been allowed to give the patient the opportunity to square the head in the normal pelvic axis a persistently abnormal drive must be suspected. This is especially true if the pelvis is of adequate size. Some of our recent studies tend to show that in many of these cases the abnormality is not so much in the direction of the drive as it is the fact that the head is held in the forepelvis by abnormalities of the soft parts so that the head cannot be directed into its proper axis which is always parallel to the sacrum. *X*-ray studies in labor are extremely valuable in this type of problem. Invariably it will be difficult to apply forceps in these cases and even if they are reasonably well applied it is difficult to bring the head well back through the proper axis. Version should be the operation of choice.

3. *Transverse Arrests in Certain Android Pelvic Types.*

S. R., aged twenty-nine years, a primipara had an android (male) type pelvis of moderate size There had been slow progress with fair contractions for twenty-two hours. At the end of that time the head had just reached the plane of the spines, R.O.T. The cervix was completely dilated except for a small rim anteriorly, and the membranes ruptured six hours. Manual rotation of the head was unsuccessful. Forceps were applied with some difficulty but rotation could not be effected. Version was decided upon and carried out with no difficulty. The baby weighed 8 lbs. 4 oz. and was in good condition.

This patient showed a typical android pelvis with characteristic flattening in the posterior half, which was carried down throughout the lower levels of the pelvis by virtue of an encroaching sacrum so that the level of arrest presented roughly the same flattened shape as the inlet. This is in contrast to other types of flat pelves, notably the gradually disappearing rachitic-flat pelvis, in which compensatory room exists below the brim. In this case, with the head high in the midpelvis in the transverse position it was impossible to rotate it because the flattened midpelvis would not allow the head to be contained in any other position than the transverse. Had labor progressed further the vertex might have been found quite low in the pelvis but still in the transverse position. If forceps are to be used successfully in these cases the head logically should be brought down to a much lower level in the position of arrest. It is often easier, however, to do a version.

4. *Certain Cases of Occipitoposterior.*

H. B., aged twenty-two years, a primipara with a normal pelvis had been in labor twenty-two hours when the fetal heart became irregular. Examination at this time showed the cervix to be four and one-half fingers dilated, the anterior lip was edematous and presentation, R.O.P., with the head just above the spines. Attempts at manual rotation, Barton forceps and the Scanzoni maneuvre all failed. Version, which in this case was tried as a last resort, was surprisingly quite easy. The child weighed 7 lbs. 9 oz. and was in good condition.

A stereoroentgenogram of the pelvis in this case was taken during the postpartum period to check the clinical diagnosis, and it was found to be of a very typical anthropoid variety. The shape of the pelvis also clarified the operative difficulties which were encountered. In many respects the underlying mechanical problem is similar to what was said about the transverse arrest in the android pelvis. In the typical anthropoid pelvis there is transverse contraction which favors an occipitoposterior position and in the more extreme cases in which the

midpelvis duplicates the long oval shape of the inlet it is impossible to rotate the head unless moulding has so changed the diameters of the head that they are nearly all of the same length as noted when the head becomes long and cylindrical in shape. Again, if forceps are to be used in these cases the head must be brought down to a much lower level in the posterior position before rotation can take place.

5. *Brow Presentation.*

H. K., aged thirty-nine years, a para II with a normal pelvis had two previous normal deliveries. Labor started with rupture of the membranes; the head was floating. After twenty hours of labor characterized by uterine inertia the examination showed that the cervix was fully dilated with the brow presenting. An attempt was made to flex the head, which was partially successful. Flexion could not be maintained when digital pressure was released and since the patient's contractions were very weak, there seemed to be little promise of success by continuing along this course. Version was consequently done and a 9 lbs. 7 oz. child was delivered in good condition.

Brow presentations which cannot be corrected should always be treated by version if delivery per vaginum is attempted. Face presentations in which the chin points toward the hollow of the sacrum are also best treated in this way.

6. *Transverse (Shoulder) Presentations.*

A. L., aged twenty-nine years, a para II, had a normal pelvis. During the last month she developed a mild toxemia of pregnancy. Vaginal examination after two hours of labor showed the cervix to be three fingers dilated. The presenting part was very high and not definitely identified and was thought to be a breech. Four hours later the cervix was fully dilated but still the presenting part was too high to be identified. The membranes were ruptured and a good deal of fluid came away; polyhydramnios. The right shoulder was found to present with the back anterior. Internal version followed by breech extraction was done with some difficulty due to the large baby, which weighed 10 lbs. 4 oz. and was in good condition.

Transverse presentation should always be treated by some form of version if delivery is to be accomplished by the vaginal route. Early in labor correction may be attempted by external version followed by the use of appropriately fitting abdominal pads. If this fails it is best to introduce a Voorhees bag and deliver the child by internal version when dilatation is complete.

7. *Placenta Previa.*

A. S., aged thirty-seven years, a para II, normal deliveries, was admitted to the hospital two weeks before term with the history of painless bleeding for two hours. Examination showed the membranes intact with the vertex presenting; cervix soft and two fingers dilated. The placenta covered the posterior half of the cervical opening. A No. 5 Voorhees bag was inserted. Four and one-half hours later the bag was expelled. The cervix was fully dilated and bleeding was profuse. The fetal heart rate fell to 50 beats. Version controlled the bleeding satisfactorily. This was followed by extraction which was carefully and slowly carried out. The baby weighed 6 lbs. 1 oz. and was in good condition.

This is a typical case of placenta previa treated by the introduction of a Voorhees bag and version. The case is especially instructive because it shows that even when the fetus is apparently seriously compromised the version should be done very slowly and carefully with apparent disregard for the fetus. The lower uterine segment in placenta previa tears like wet paper and one careless move may lead to disaster. Had the operator in this case forgotten this point and in an attempt to extricate the dying fetus had rushed the operation, he might well have injured both the mother and child. As it was the baby lived, but had it been born dead there still would have been complete justification for the method of handling the version-extraction.

8. *Placenta Previa; Braxton Hicks Version.*

R. M., aged twenty-five years, para II, was admitted to the hospital at term with moderate bleeding and uterine contractions. On examination under anesthesia preparatory to

inserting a Voorhees bag the cervix was found to be three fingers dilated. Bleeding became so profuse during the examination that it was decided to do a Braxton Hicks version. With the fingers through the partially dilated cervix the head was displaced into the false pelvis while pressure was made downward over the breech until one foot could be grasped. Traction on the foot and pressure upward on the head completed the version and in this way the hemorrhage was under complete control. Dilatation of the cervix was complete after one hour, after which time the child was slowly extracted. The child died shortly after birth.

A Braxton Hicks version as illustrated by this case has been the means of saving many lives. It usually can be done without a great deal of difficulty if the cervix is at least three fingers dilated. The unquenchable desire to exert traction on the leg after it has been brought down must be curbed even though it takes hours before dilatation is complete, for, as mentioned previously, any stretching of the lower uterine segment in placenta previa will almost inevitably result in tearing it.

9. *Prolapsed Cord.*

N. F., aged twenty-eight years, para 0, was a nephritic toxemia with late acute symptoms and was inducted at term with castor oil and quinine. After eleven hours of labor the examination showed that the head was in the pelvis, cervix fully dilated and the membranes intact. The membranes were consequently ruptured and with the ensuing gush of fluid the cord prolapsed. The patient was immediately placed in the Trendelenburg position and while she was being anesthetized the head was held up from below so that pressure on the cord was avoided. When fully anesthetized a version followed by breech extraction was done. The baby was in good condition and weighed 6 lbs. 2 oz.

When the cord prolapses even though the head is engaged, as noted in this case, the baby is usually small in relation to the pelvis and version can be accomplished with comparative ease. If on the other hand the head is unengaged it is important to bear in mind that frank disproportion may exist in which event version is contraindicated. In multiple pregnancy the second twin is commonly delivered by version if delivery does not take place soon after the birth of the first. Prolapsed cord and premature separation of the placenta occur often enough to make this procedure a truly prophylactic one.

10. *Cord around Neck; Short Cord.*

A. Mc., aged twenty-seven years was a para 1. After eight hours of uneventful labor the membranes ruptured and the patient began to have second stage pains. The fetal heart beats which had previously been regular became slow and irregular in rate, especially with each contraction. A prolapse of the cord was suspected and vaginal examination was made. The vertex was in the L.O.A. position at the level of the spines, the cervix was fully dilated, but no cord could be felt. Forceps were easily applied and with each traction the fetal heart rate became very slow and as a result the operation was discontinued. The anesthesia was deepened and the hand introduced into the vagina for further investigation. In this way several loops of cord were palpated around the child's neck. The head was then pushed out of the pelvis and a version and breech extraction accomplished. There were four loops of cord around the neck. The weight of child was 7 lbs. 6 oz. and was in good condition.

This case illustrates an uncommon but justifiable indication for version.

CONTRAINDICATIONS

1. The first and most important contraindication to version followed by extraction is the undilated cervix. Disregard for this rule inevitably results in difficulties. If version is indicated when the cervix is not completely dilated it must be further dilated manually or incised before any attempt to turn the child is made. Manual dilatation, being in reality a combination of stretching and tearing, is permissible only when the cervix is at least four fingers dilated under which circumstances the tearing will be minimal. If delivery is imperative in the face of lesser degrees of dilatation the cervix should be treated by incision rather than by manual methods in order to avoid tearing and the resulting

inadequacy of dilatation. In placenta previa a Braxton Hicks version may be done before complete dilatation of the cervix but in these cases extraction of the child must be delayed until the cervix becomes dilated of its own accord. Manual or instrumental dilatation of the cervix in placenta previa is never done because of the possibility of tearing the lower uterine segment.

2. Version is contraindicated when the presenting part has become so wedged into the pelvis that undue force is required to displace it;

3. When the uterus is in tetanic spasm or presents an hour glass contraction (high contraction ring);

4. When the available pelvic space is so contracted that it is incompatable with the delivery of a living child;

5. When the uterus is dry and its walls are firmly applied to the body of the child. In this connection it is well to point out a misconception which arises in the relationship between a dry uterus and the duration of ruptured membranes. A version will often be found to go easily even after the membranes have been ruptured a long time, while a difficult version due to a dry uterus may result shortly after the membranes have ruptured. These cases are explained by the fact that the duration of ruptured membranes is not in itself an index of the amount of residual amniotic fluid. The residual amount of amniotic fluid is dependent largely on the degree of uterine retraction which in turn is dependent upon the strength and character of the uterine contractions. With good pains and efficient retraction, the space between the uterine wall and the fetus which is occupied by amniotic fluid gradually approaches zero as a limit while with inertia and weak pains this space, due to poor retraction, does not diminish appreciably and may remain filled with residual fluid long after the membranes have ruptured.

TECHNIQUE

In any discussion of version the name of I. W. Potter of Buffalo deserves to be mentioned. To him goes the credit for giving us the best technique that has been devised for carrying out the operation. Very few agree with his indications but nearly all subscribe to his technique. At the Sloane Hospital for Women the Potter technique with slight modifications is employed. The patient is carefully prepared as for any surgical operation. Preferably two attendants hold the legs so that they may be raised or lowered easily and quickly. The bladder is emptied and the pelvic floor is thoroughly ironed out using sterile cotton seed oil as a lubricant. The attendant wears elbow length gloves. Anesthesia with a mixture of nitrous oxide-oxygen-ether is gradually deepened to the surgical level in order to relax the uterus completely. Chloroform gives the greatest degree of relaxation and would be ideal in these cases were it not so toxic. It is now only occasionally used in some cases presenting a contraction ring.

The hand is introduced into the vagina by inserting one finger at a time, each finger making room for the succeeding one by pushing back the pelvic floor. The membranes are ruptured high up, thus retaining as much of the amniotic fluid as possible. The hand is now very gently pushed up alongside the head and in so doing the latter is simultaneously displaced upward if it has already entered the brim. The choice of hands has been a source of much discussion in all obstetrical texts. Obviously for the ambidextrous individual it is more advantageous to introduce the right hand when the small parts are directed toward the left of the uterus and the left hand when they are located on the opposite side. Actually in practice one finds it best to use the hand with which he has become more facile in carrying out vaginal manipulations.

Now the hand is pushed up alongside the child's body. At this point it is well to pause for a moment to investigate the disposition of the cord, arms and legs. The cord can be loosened or moved in such a manner that it will not be subjected to traction. The arms are folded across the chest if they lie

alongside the head or body. Both feet are identified by the distinguishing heel and are held between index, middle and ring fingers. If only one leg can be grasped choose the anterior leg if possible. As the feet are brought down, toes up, the outside hand acts to steady the uterus and at the same time to exert some pressure upward on the head. The buttocks are brought down in apposition to the sacrum. This allows the child to use all available pelvic space without angulating its body. When the buttocks reach the hollow of the sacrum they will have to undergo internal rotation which is accomplished by gentle traction on the anterior foot. Continued traction downward brings the back around parallel to the symphysis and straight across the outlet. This part of the delivery should be done very very slowly in order to effect the maximum degree of dilatation of the pelvic gutter by the buttocks. In the majority of cases it is desirable to do an episiotomy at this stage of the delivery. The exposed parts of the child are covered with warm wet towels to avoid the stimulating effect of room temperatures on the respiratory center. As soon as the umbilical insertion of the cord presents a loop should be pulled down so that traction on the umbilicus is avoided.

Further traction engages the shoulders in the transverse diameter of the inlet and when they have passed the inlet the hand is introduced parallel to the symphysis to push back one shoulder into the hollow of the sacrum. This rotation of the shoulders can be accomplished by turning the child's pelvic girdle but this imparts an unnecessary degree of torsion to the child's body. Traction is now made downward and backward to allow the shoulder to engage under the symphysis. At this juncture the scapula appears at the vulva. The anterior arm is now delivered by passing the fingers alongside it and sweeping it down across the chest. If a nuchal hitch occurs attempts to disengage it should be made as follows:

1. By pushing the trunk upward as if to push the child back into the birth canal while the fingers try to sweep the arm over the occiput;

2. By exerting pressure upward at the angle of the scapula;

3. By turning the child completely around and attempting to deliver the arm posteriorly.

After the arms are born the body, resting on the attendant's arm, is kept parallel to the woman's thighs. Two fingers of this supporting hand are introduced into the vagina to find the child's mouth, and are placed on the upper maxilla to exert pressure downward in order to keep the head flexed. With the clenched fist of the other hand steady downward pressure, parallel to the symphysis, is made over the fetal head until the occipital proturberance appears. No traction is made with the fingers in the vagina at any time. The abdominal hand is then placed over the back of the child's neck so that the index and the ring fingers encompass its sides while the middle finger acts as a splint. The other hand at this point is still maintaining flexion. With the hands so disposed the entire body is swung upward without angulating the neck. The baby's mouth appears at the vulva and breathing may be established before the remainder of the head is swept over the pelvic floor.

Every step of the version operation must be carried out with extreme care and with little regard for the time element. The length of time allowable in any case is the length of time that is necessary to do a good version. In this connection it is well to emphasize a point which must always be borne in mind, that postmortem examinations conclusively prove that version-extraction stillbirths present much evidence of birth trauma and very little evidence of asphyxia.

SUMMARY

This paper deals primarily with the clinical aspects of the version operation. The indications, contraindications and technique of both the external cephalic and internal podalic version are discussed.

INDICATIONS AND TECHNIQUE OF EPISIOTOMY*

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AFTER discussions dating back a century or more and continuing till within a few years ago, little argument now exists as to the justifiable inclusion of episiotomy among the valuable surgical procedures of obstetrics. However, as to the frequency with which this operation is to be undertaken, the special indications for its use and the direction and depth with which the incisions are to be made, much difference of opinion persists. A great variety of incisions have been described. These have included the true lateral episiotomy now fallen largely into disuse, the multiple small nicks of the vulval ring suggested by von Ritgen, the mediolateral incision, which strictly speaking is the only true episiotomy used today, and the midline incision of the perineum, more correctly termed perineotomy.

The general aims of episiotomy are stated simply. The fetus is to be protected from the effects of a prolonged second stage, particularly from certain injuries which may result when the head acts as a dilator of resistant perineal structures. The mother is to be saved from the general effects of a long labor and the local results of either the uncontrolled stretching of the supporting structures of the pelvic floor, or from irregular, misdirected lacerations.

With these as the general purposes, the following specific indications for episiotomy may be noted:

1. *Fetal Indications.* In any situation in which danger to the fetus calls for a rapid delivery, episiotomy may be of assistance, whether delivery be accomplished by forceps or by breech extraction. In particular is this advisable in the delivery of premature infants, where the wide sutures and soft bones of the fetal skull offer little protection and the poorly developed vascular system and weak connective tissue supports predispose to intracranial lesions. Hence, with the premature infant, episiotomy with or without the application of properly selected forceps may be a means of prevention of birth injuries otherwise only too common.

2. *Protection of the Structures of the Pelvic Floor.* An episiotomy is indicated for the protection of the maternal soft parts in a wide variety of circumstances. Among these are the rigid perineum of the elderly primipara, the scarred perineum following previous plastic operations, the edematous vulva in toxic patients or after long labor, and certain types of anomaly. Among the last may be mentioned the very high perineum, said to be associated with genital hypoplasia with a long space between the introitus and the anus in which a median perineotomy is usually safe, and the very narrow perineum in which a mediolateral episiotomy may be essential to save a tear into the sphincter.

Episiotomy is advised in these cases as a means of preventing serious lacerations, especially those involving the sphincter muscle. In addition, however, it undoubtedly protects the subcutaneous and submucosal structures from the over-distention which results in rectocele and relaxation of the pelvic floor. That episiotomy may reduce the incidence of cystocele, especially when performed fairly early, has been maintained by several writers.

An extreme view that all primiparae should be aided in their delivery by at least

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a small incision of the perineum has been taken by some obstetricians (Pomeroy). An unvarying policy in this respect seems scarcely justified, but the mother's future comfort will be given the best consideration and her first child protected, if after the caput is in sight, the operator holds himself in readiness to perform episiotomy in the event either of threatened spontaneous laceration or undue delay in delivery.

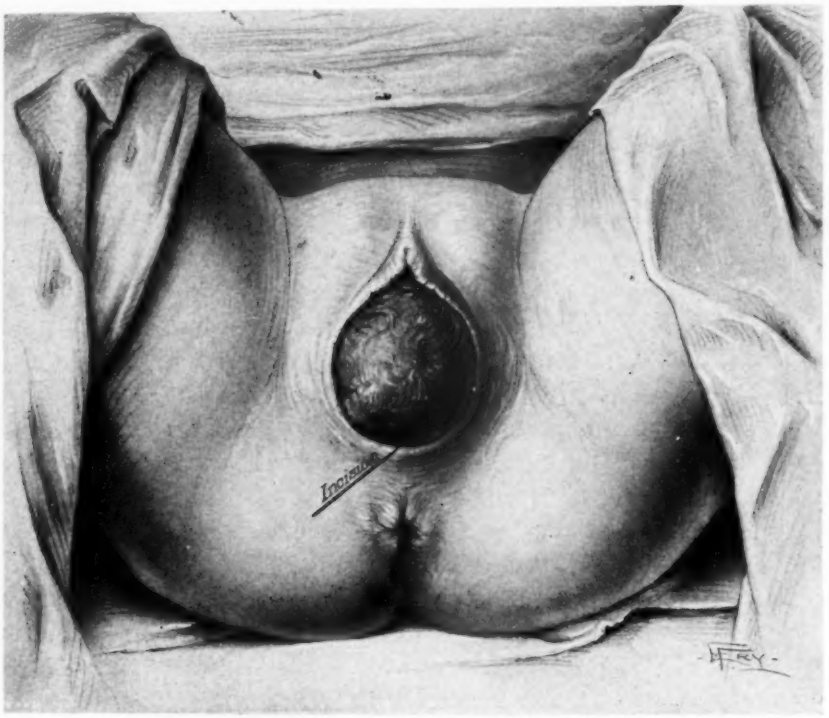

Fig. 1. The incision in mediolateral episiotomy.

3. *Malpresentation and Disproportion.* The presence of a narrow pelvic arch associated with a short bi-ischial diameter, is well known to require that the head descend very low before extension and delivery are possible. With this type of subpubic angle, found particularly in the funnel or android types of pelves, mediolateral episiotomy may be essential to prevent a third degree laceration. Little, in particular, has been impressed favorably by the advantages of incision of the perineum when this form of pelvis is present.

With incomplete flexion of the head requiring a passage of a longer diameter of the fetal skull through the vulva, episiotomy may be indicated from the size of the passing body alone. With the occiput persistently posterior, the mechanism of delivery by flexion again requires that the head pass far down and backward, stretching the vulva, especially in its posterior segments, so that uncontrolled tears may be particularly dangerous. In these situations, extensive episiotomy may be essential to prevent serious injury to the pelvic floor or the anal sphincter.

4. *Episiotomy with Operative Delivery.* Forceps deliveries require episiotomy for several reasons, most often perhaps because of the rapidity with which the delivery through the vulva is apt to be effected, the gradual stretching of the parts not having taken place, at least when the instruments are applied in the midposition. Furthermore, the direction of the pull in order to make the axis of traction coincide with that of the pelvis often produces injuries of the perineum from the instruments themselves before the head has begun to press on the pelvic floor. This type of injury is especially liable to occur from the Kielland forceps with their relative absence of the pelvic curve, and, when these instruments are

used, an early episiotomy is often necessary. Forceps with considerable separation of the shanks, such as the Simpson forceps

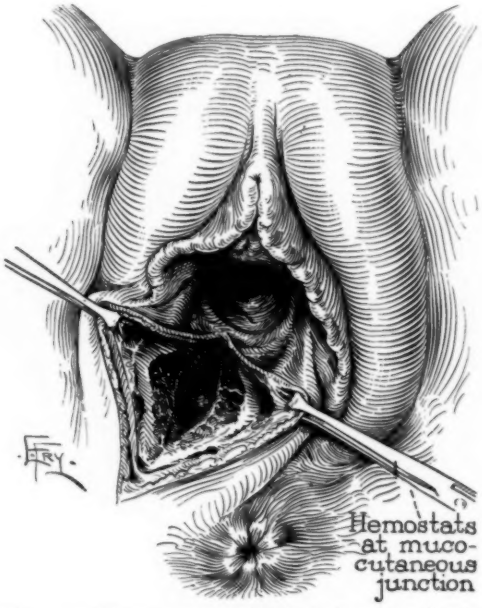

Fig. 2. Exposure of field before beginning repair.

and its derivatives, offer more chance of injury and may require episiotomy more often than do those with the shanks closer together, yet are preferable in some instances, since they offer less chance of injury to the fetal head. Episiotomy may be required in breech delivery, especially when difficulty is encountered with the arms or after-coming head.

The type of episiotomy to be employed still offers a fertile field for argument, in particular between those who favor the median perineotomy and the advocates of mediolateral episiotomy. For the former it may be said that it produces a symmetrical wound, easily approximated in the midline; that important muscles are not injured; and that scar tissue when formed involves the tendinous insertions of the muscles already composed largely of connective tissue. Its chief disadvantage lies in the threat of its extension, so as to cause injury of the rectal sphincter. Its more enthusiastic advocates have made light of this danger, however, maintaining that little permanent harm is done, when the sphincter is torn through an anatomically correct and easily repaired midline perineotomy (Pomeroy). Another objection which has been advanced is that the incision lies in the direct line of the lochial discharge which favors infection and the breaking down of the healing wound.

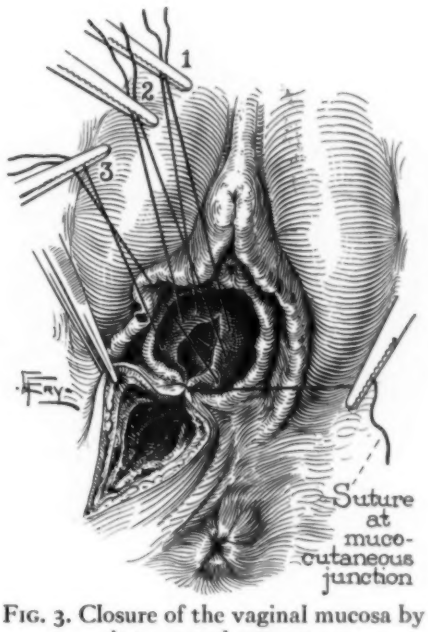

Fig. 3. Closure of the vaginal mucosa by interrupted sutures.

The mediolateral episiotomy, obliquely placed and carried perhaps through some of the fibres of the levator ani muscle, involves structures more difficult to repair. This is especially the case when after the delivery of the child, anatomically corresponding parts are no longer opposite each other on the two sides of the incision. The accurate repair of the important tissues of the pelvic floor under these circumstances requires more skill and care than does the reconstruction of the perineum after the midline incision. Certain advantages, however, make this incision the one of choice under many circumstances. First and foremost is the fact that the accidental extension of this incision during the course of delivery does not endanger the sphincter or the rectal wall, but only carries the division of tissues laterally deeper into the levator muscles. The opportunity given to incise the more superficial fibres of the levator

ani and to perform under rare circumstances a bilateral episiotomy affords room that cannot be safely secured by the wide access is required for some operative procedure, the mediolateral incision is preferable. There remains probably the

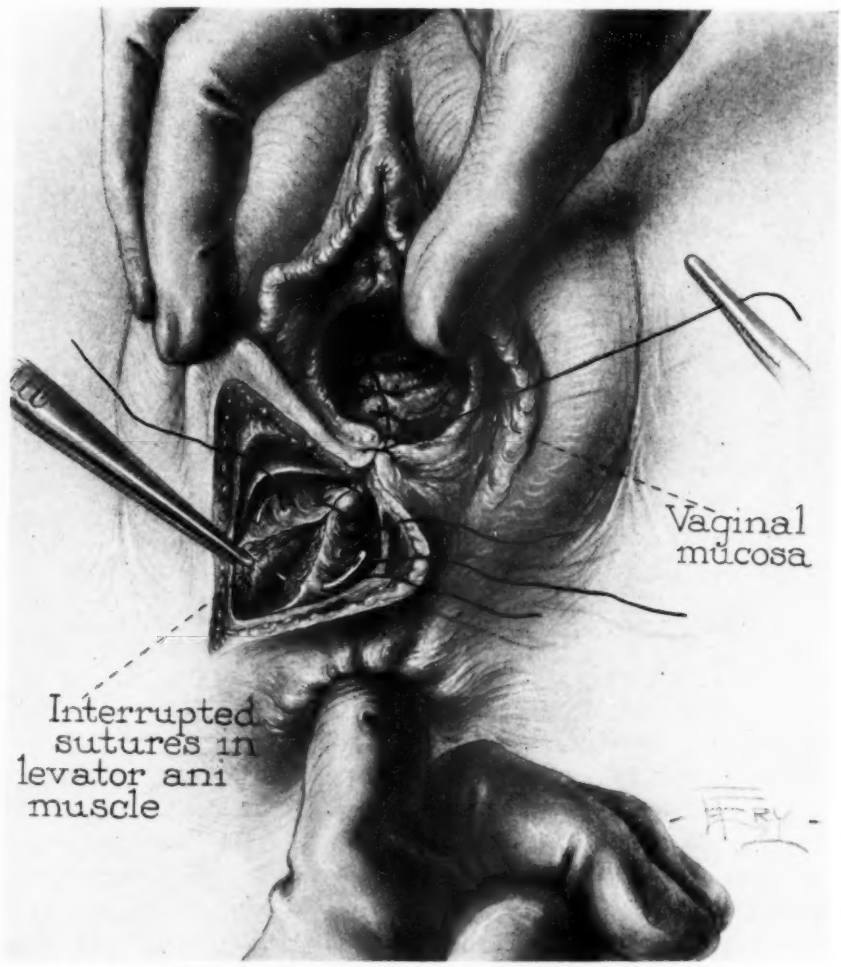

Fig. 4. Repair of anterior fibres of levator ani.

median incision. Finally it must be conceded that with a little experience the operator becomes able to perform and repair this incision with end results as perfect as those obtained after the simple median perineotomy.

Both incisions have their special indications. When only a little increased room is needed to effect delivery, when the perineum is broad and no great laceration is anticipated, the median incision is done easily and more quickly repaired, so that the patient is subjected to the least possible surgery and anesthesia. When there is a marked threat to the sphincter as in cases of persistent posterior occiput or in women with a narrow subpubic angle and where majority of the cases in which the experience and preference of the operator may justifiably be the chief criterion for a decision.

The technique for median perineotomy has been described recently and well illustrated by Little in the System of Obstetrics and Gynecology edited by Curtis. The steps in the performance and repair of mediolateral episiotomy to be outlined here follow in general the technique in use on the division of obstetrics at the Bellevue Hospital and that taught to the internes and residents of that service. It is a method followed because of its practicability and the simplicity with which it can be taught to a series of rather frequently changing

internes. That it is efficient and satisfactory has been demonstrated by the rarity with which primary union is not attained and

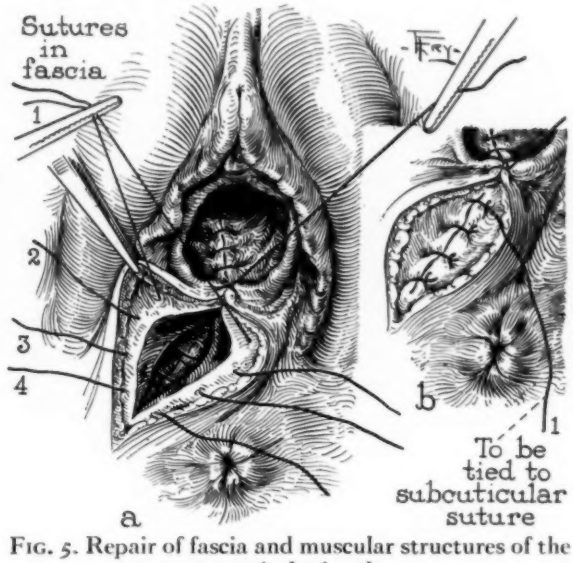

Fig. 5. Repair of fascia and muscular structures of the urogenital triangle.

the satisfactory character of the scar after healing.

Exact definition of the optimum time during delivery in which to perform episiotomy is difficult to give. Delivery must be anticipated within a few minutes, for otherwise there will be unnecessary bleeding in the second stage. The head must be well down on the pelvic floor, the caput in sight, and the perineum bulging except in certain cases of operative delivery in which special access is required or the manipulations have already begun to injure the perineum. Certain writers recommend waiting until the imminence of a laceration is shown by a blanching of the vulva and perineal skin, or until minute tears are actually visible in the vaginal mucous membrane about the introitus, as the head recedes slightly between pains. If possible the cut should be made, however, slightly before these signs are evident, because when blanching or superficial lacerations are present, permanent damage to the muscular structure of the pelvic floor may already have occurred. The tendency is in most cases to delay too long rather than to incise prematurely.

The incision is begun near the midline posteriorly and carried downward and backward about midway between the anus and the tuberosity of the ischium. The instrument used is usually the scissors, but

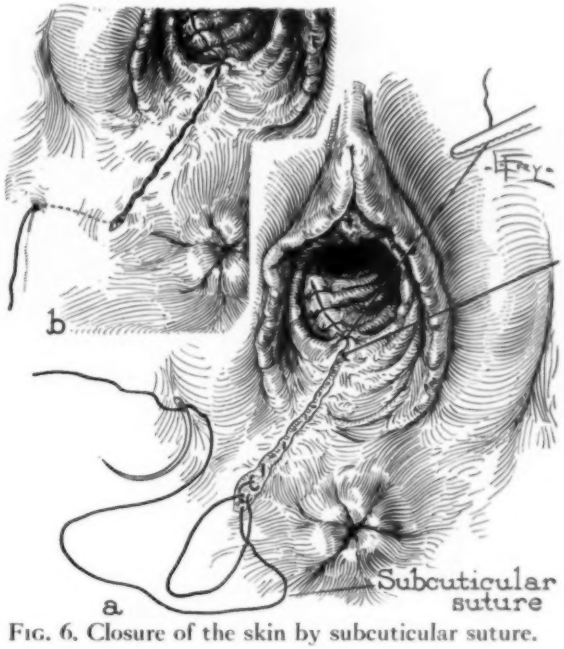

Fig. 6. Closure of the skin by subcuticular suture.

with care a scalpel which makes a very clean incision may be employed. The cut involves both vaginal mucosa and the skin over the ischiorectal space, each for a distance varying from 2.0 to 5.0 cm. The deeper subcutaneous structures divided include the bulbocavernosus, and the two transversus perinei muscles with the fascia of the urogenital triangle, and with the deeper incisions, the superficial fibres of the pubococcygeal portions of the levator ani muscle. The episiotomy is usually made on the right side, although it has been advised that it be placed on the side of the occiput. Bleeding may be brisk if the delivery is delayed at all. If much blood is being lost, the ordinary measures for hemostasis with clamps and ligatures should be instituted, a procedure often wholly neglected in the tension of a difficult delivery. Ordinarily most of the bleeding will cease as soon as the delivery is completed.

The patient is partially redraped following delivery, and fresh gown, instruments and gloves are given to the operator. The placenta, if separated, may be delivered before the repair is begun, or this postponed

till the operation is completed. A gauze pad with a tape, carrying a ring or clamped to the sheets draping the patient, is inserted into the vagina to keep the blood from obscuring the work of repair. The apex of the incision and the points on each side where the incision crossed the mucocutaneous junction are located to give proper orientation. Actively bleeding vessels may be caught and tied and small fragments of crushed, devitalized tissue trimmed away.

1. The vaginal portion of the incision is first repaired from the apex of the incision to the mucocutaneous junction by a series of interrupted sutures of chromic catgut. Care is taken that corresponding points on the two sides are approximated. The final suture at the lower margin of the vagina is kept long and held with a clamp as a guide.

2. The deeper structures, especially the cut fibres of the pubococcygeal portions of the levator ani, are next repaired with a second series of interrupted sutures of No. 2 chromic catgut. At this stage a finger placed in the rectum may prevent the penetration of that organ and the spread of infection by the needle, although with experience this maneuver will rarely become necessary. Needless to say the glove of the hand used must at once be changed. Special effort is sometimes necessary to place the sutures deep enough to eliminate the dead space and approximate portions of the divided levators lying beneath the roof of the repaired vaginal mucosa.

3. The second tier of sutures in the lower half of the incision approximates the deep and superficial layers of the urogenital diaphragm and the structures lying between and above these fasciae. The actual muscles are rarely seen, but the most anterior suture, passed upward into the lower segment of the labium minus, should catch the bulbocavernous muscle and by approximating this to a point near the midline prevent gaping of the vagina and any tendency of the perineum to sag backward and toward the opposite side.

4. The skin may be closed in a variety of ways. A subcuticular continuous suture of No. 2 catgut is employed frequently. This is started near the mucocutaneous junction and carried posteriorly, where it may be looped and tied to itself or by a wide sweep of the needle beneath the skin lateral to the suture line brought back to the starting point and fastened to its own original end. A series of simple interrupted sutures of either catgut or dermol probably give as satisfactory results and should be used when there is the least indication for haste.

CONCLUSION

It may be emphasized that the correct use of episiotomy forms one of the niceties of obstetric practice. The consideration of whether to undertake the operation in a given case demands the balancing of a known type of surgical injury against an unknown degree of trauma from the stretching effects of the presenting part against the perineum. Regret for having performed needless episiotomy is probably less frequent and certainly less permanent than that experienced at times for having omitted it.

MANAGEMENT OF BIRTH INJURIES

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AS is true of many abnormal obstetrical conditions, especially the accidents, the most important feature in the management of birth injuries is their prevention or avoidance. Hence, in this discussion of the various injuries, the prophylaxis will be given prime consideration.

RUPTURE OF UTERUS

Rupture of the uterus should, and in almost all instances can, be prevented by:

1. Recognizing in advance the existence of conditions which may lead to rupture, and

2. In any case, especially of mechanical dystocia or in which factors predisposing to rupture exist, maintaining constant watchfulness for the earliest evidences that rupture threatens.

No case should ever be permitted to progress beyond the stage of threatened rupture.

Etiology. There are four causes of rupture of the uterus:

1. Weakening of the wall of the uterus by scars of previous operations (cesarean section, myomectomy, salpingectomy, etc.); intramural fibromyomata; localized or diffuse fibrosis; invasion of the myometrium by hydatidiform mole; congenital abnormalities of development. In such cases rupture may occur even with rather weak contractions of the uterus.

2. Subjection of a more or less normal uterus to excessive strain through the coexistence of vigorous contractions with a marked or insuperable obstacle to the advance of the fetus, such as rigid or even spastic cervix; fetomaternal disproportion in any of its forms; the presence of such obstacles as tumors impacted in the pelvis; stenosis or fibrosis of the vagina; abnormal inelasticity of the perineum, etc.

3. Excessive uterine contractions in an otherwise normal patient; this is rarely sufficient to cause rupture except in cases where pituitrin has been employed to "strengthen the pains."

4. Direct or indirect trauma: rupture through indirect, or external direct trauma is exceedingly rare; rupture through direct internal trauma (forcible version, gashing or tearing by the blades in the high application of the forceps) should be wholly avoidable.

Pathology. The pathology of traumatic rupture is obvious. A discussion of the histology of weakened areas in the uterus is not feasible in a brief paper. In cases of rupture as a result of violent contractions, or of obstacles to the advance of the fetus, or of combinations of these, the pathologic sequence is somewhat as follows: the fetus having encountered an adequate obstacle to its advance, the contractions of the active segment of the uterus are necessarily diverted to an expenditure of force upon the passive segment (especially if the cervix or the lower part of the passive segment is not retracted over the presenting part of the fetus, or is "jammed" between the fetus and the walls of the birth passage). This force stretches the passive segment upward and makes it progressively thinner, especially over some prominent projecting part of the contained fetus. By degrees the cellular bundles of the structure of the passive segment begin to separate; and ultimately a point is reached at which gross separation occurs and the rupture is established. The rent may occur in any part of the passive segment, but is usually oblique

and anterior. There are three degrees of rupture: (1) minor, which are probably rather common but not clinically evident unless the rent involves a large vessel (the writer has encountered 3 such instances); (2) incomplete, in which the rent extends through the myometrium but not through the overlying peritoneum; (3) complete, in which the peritoneum is torn, the contents of the uterus escaping wholly or in part into the abdominal cavity.

Clinical Evidences. There are three stages in the progress of rupture of the uterus, except in some cases of rupture through a weak area in the myometrium, when the rupture may occur without warning and sometimes without immediate clinical evidence of its occurrence.

1. Threatened rupture: The patient complains of a "different sort of pain," usually localized over the passive segment. This pain becomes progressively more intense and more prolonged after the cessation of each contraction until it is continuous, with very severe exacerbations during each contraction. As a rule the contractions become more frequent and more forceful. By degrees it becomes possible to determine by palpation that the active segment is becoming thicker and the passive segment thinner as labor continues, until the line of demarcation between the active and passive segments is markedly evident (in some cases even visually). The fetus may be abnormally easy to palpate through the thinned-out uterus. No case should be permitted to progress beyond this stage.

2. Impending rupture: All of the evidences of threatened rupture described are greatly intensified. The patient almost always develops a sense of impending disaster. The contractions become almost continuous, with little or no interval.

3. Actual rupture: With the giving way of the myometrium there is a sudden crisis of pain and severe shock, and the active segment passes either into tetanic contraction or total relaxation. The hemorrhage is usually profuse but may be entirely internal, the blood escaping into the uterine or abdominal cavity with little or no external bleeding. The fetus may be palpated partially or wholly outside the collapsed or contracted uterus. Death may occur within a few minutes; if deferred, the evidences of peritoneal irritation in complete, or of extraperitoneal hematoma formation in incomplete rupture become progressively more apparent.

Management. The essential feature in the management of rupture of the uterus lies in its prevention through:

1. The foreknowledge of conditions which may predispose to rupture;

2. The avoidance of procedures which may lead to rupture, chiefly in avoiding the use of pituitrin in the first and second stages of labor (which is the commonest cause of rupture today);

3. The prompt recognition of the early evidences of threatened rupture; and

4. The prompt institution of measures to meet the situation as it exists. These measures are:

A. Before actual rupture:

1. Diminution of the force of the uterine contractions, by immediate anesthesia to the point of stopping the uterine contractions entirely, and by maintenance under lighter anesthesia until the preparations for transfusion and the termination of labor are complete.

2. The actual termination of labor. The general rules for the termination of labor are:

a. If the cervix is fully dilated and the presenting part has reached at least the midpelvic position, and there is no considerable element of mechanical dystocia, forceps or extraction may be done;

b. If the cervix is not fully dilated, if the presenting part is in the upper pelvis, if there is either malposition or an element of mechanical dystocia, cesarean section is the only justifiable means of delivery. Version, epecially, is absolutely contraindicated, as it almost always results in actual rupture under the circumstances. The risk to the patient from precipitating rupture with its consequent hemorrhage, outweighs the

risk of potential or even actual infection as a contraindication to cesarean section. In infected cases, and in cases in which a permanent factor predisposing to rupture exists, hysterectomy should be done.

B. Actual rupture: Immediate cesarean section and hysterectomy with transfusion as promptly as possible is the only justifiable measure.

If the case occurs in the home the recognition of threatened rupture and removal to the hospital under anesthesia deep enough to control the contractions is usually the only measure which will preserve the life of the mother.

LACERATION OF THE CERVIX

Prophylaxis. Less can be done, except through the avoidance of certain procedures, to prevent laceration of the cervix, than is the case in regard to rupture of the uterus and laceration of the perineum.

Pathology. In every case of labor myriads of mucosal lacerations of the cervix occur. It is impossible to dilate a passage of the calibre of a slate pencil to the diameter of four inches or more without some damage. At the same time there is considerable disintegration of the fibromuscular structure of the stroma. To appreciate the damage to the mucosa one must expose the apparently intact cervix at the end of the second stage of labor and dye it with iodine, when the epithelium will be seen as an archipelago of tiny islands dotted over a surface of raw stroma. Such minimal lesions are of little importance except as portals of entry for infection; Nature takes care of them very well except for the rather frequent occurrence of residual heteroplasia or granulations, which can be treated after involution is well in progress. My own classification of the grossly apparent lacerations of the cervix is as follows:

First Degree. The minor slit-like tear which is commonly regarded as normally distinguishing the parous from the nulliparous external os;

Second Degree. Involving only the portio vaginalis to a point below the reflection of the vaginal wall;

Third Degree. Extending through the level of the superficial structures of the vaginal vault;

Fourth Degree. Extending above the vaginal vault to or above the external os, or involving deep tears of the pelvic diaphragm (base of the broad ligament, etc.).

Lacerations of the cervix may be unilateral, bilateral, anterior, posterior, stellate, wholly irregular, perforating or amputative.

From the obstetric point of view, recent lacerations are most important as a source of hemorrhage or as a breaking-down of an essential part of the local mechanism of defense against infection. The old laceration is important as a starting point for a new and more extensive tear, or as a possible factor in dystocia through the inelasticity of the scar. In the average case the accompanying chronic inflammation or heteroplasia is more important than the laceration itself as a source of infection, as a hindrance to involution, or as a factor predisposing to the development of cancer.

Management. Very little if anything can be done to prevent the occurrence of laceration of the cervix, except through the avoidance of procedures intended to hasten the process of dilatation. It is impossible to dilate a cervix rapidly without at least superficial lacerations; if dilation is done very rapidly the laceration may become very extensive. The commonest cause of laceration of the cervix lies in attempts at manual dilatation, with the idea of shortening the last part of the second stage of labor. Hydrostatic bags are less apt to cause serious laceration, but frequently account for minor tears. A very common cause of serious laceration lies in the attempt to perform extraction through the incompletely dilated cervix; a procedure which should be avoided, not only on this account but because of the risk of serious or fatal injury to the child. The employ-

ment of any measure intended to hasten labor through increasing the force of uterine contractions (pituitrin) often causes laceration of the cervix.

If laceration occurs it is usually manifested by the continuous passage of fresh blood. Very often the pressure of the presenting part controls this bleeding to an extent which prevents its becoming evident until after the fetus is delivered. Even an extensive laceration of the cervix may occur without serious hemorrhage at any time; but in the majority of cases there is a continuous flow of blood which is lighter in color than the blood flowing from the uterus proper. If the laceration involves an artery the difference in color is very evident. Hemorrhage of this type may be further differentiated from the normal bleeding by the fact that it is continuous and does not vary in amount with the relaxation and contraction of the uterus. Such hemorrhage definitely calls for control by ligature or suture. Having exposed the cervix for this purpose it is of course logical that the laceration be repaired.

The objection to searching for and repairing lacerations which do not bleed profusely at the time of labor lies in the fact that it is impossible to do this without introducing a certain element of risk from infection. With proper hospitalization this risk is virtually negligible; otherwise it is so serious that it is a distinct contraindication to exposure or repair of the cervix except in the case of hemorrhage which must be stopped. There is a great difference of opinion regarding the routine inspection and repair of the cervix at the time of labor under proper hospital conditions. Probably most obstetricians believe that it is better to defer repair of the cervix for two reasons: (1) the risk from the introduction of infection as mentioned; and (2) the difficulty in recognizing the traumatized structures, of apposing the surfaces accurately, and of obtaining satisfactory union in bruised, thrombosed and edematous tissues.

My own practice is to defer the repair of the cervix until the check-up examination is made at the end of four to six weeks, for two reasons; (1) a great many lacerations, especially the minor ones, heal without suture; and (2) the cervix is restored to its normal shape, the tissues are recognizable more easily, all devitalized tissue has sloughed away and the tissues and the circulation are in much better condition for proper healing. In most cases of minor unhealed laceration simple cauterization of the raw surfaces will permit spontaneous apposition and union without suture. Some obstetricians prefer to repair the cervix in seven to ten days after labor.

The essential point in regard to technique is that the sutures should not be so close together nor drawn so tightly as to interfere with circulation beyond the absolute demands of hemostasis.

LACERATION OF THE VESICOVAGINAL SEPTUM

Shallow lacerations of the anterior vaginal wall and of the anterior parts of the introitus occur very frequently. They are ordinarily so shallow and small as to escape notice except when free hemorrhage calls attention to them. They are important chiefly as potential portals for the entry of infection, or as the cause of subsequent introital dyspareunia.

Lacerations of the deeper structures of the vesicourethrovaginal septum are very common, and likewise generally escape notice because of the fact that the overlying mucosa is rarely torn. Such lacerations weaken or destroy the posteroinferior support of the bladder and urethra, giving rise to the occurrence of vesicourethral hernia, or cystocele.

The prevention of such lacerations lies in the avoidance or correction of the factors which place excessive lateral or vertical strain upon the vesicovaginal septum:

1. Excessively rapid descent (pituitrin) or extraction (poor forceps technique) of the head;

2. The occurrence of conditions in the perineal stage of labor which throw the major strain of vaginal dilatation upon the

anterior structures: when the head reaches the resistance of the pelvic floor it is arrested and deflected forward; the posterior vaginal wall, with its attachments to the underlying structures, reaches its limit of elasticity; and the major strain falls upon the anterior vaginal wall. This may be recognized by the fact that at the height of each contraction the anterior part of the introitus and the urogenital septum become tense laterally, and blanched; and the occurrence of this phenomenon calls for the immediate performance of episiotomy. Episiotomy permits the head to drop backward, and increases the diameter of the introitus sufficiently to relieve all of the dilating strain on the vaginal wall and the urogenital septum.

These lacerations can not be prevented in all cases, since the whole vaginal and paravaginal structure may be too inelastic to permit the passage of the head in even a slow and otherwise normal labor; but observance of the mentioned principles will greatly decrease the incidence of subsequent cystocele.

LACERATION OF THE PERINEUM

Prophylaxis. Laceration of the perineum, except in cases of unavoidable precipitate labor should never occur. The operation of episiotomy, whether it be performed in all cases or only in those in which laceration impends, will prevent the occurrence of laceration of the perineum. Proper judgment in planning the episiotomy should prevent the extension of laceration beyond the episiotomy wound.

Pathology. An understanding of the pathology of a perineal laceration implies a thorough knowledge of the anatomy of the structures involved by the tear. Unfortunately the anatomy of the perineum varies widely in different women; hence the extreme variation in the descriptions given by anatomists. In spite of the variation the essential structures remain the same, although they may appear in different relationships to each other in individuals.

The first degree laceration involves only the mucosa and the immediately underlying areolar tissue. Such lacerations occur in every case in which episiotomy is not done, but ordinarily pass unnoticed in the minor degrees. They are important chiefly as portals of entry for infection. Episiotomy substitutes a clean straight incision for a jagged irregular lacerated wound. The more extensive laceration may be so long, so ragged, or so undermining that its repair may constitute a very difficult task. Furthermore, the blood supply to the edges of the wound, especially in the very jagged tears, may be so impaired by thrombosis, etc., that a satisfactory end-result is delayed greatly or may fail to occur at all.

Second degree laceration involves the deeper structures of the perineum to a variable extent, in the most extreme cases tearing through the entire perineal body or the vaginal sling of the levator ani muscle to and sometimes around the sphincter ani. It is because of imperfect understanding of the basic anatomy of the structures involved that perineal lacerations of the second and third degrees so often are repaired inadequately. If, in addition to a variable anatomy, the structures themselves are rendered unrecognizable by mutilating irregular lacerations, the problem may be entirely insuperable even to a skilled obstetrician. Here again, episiotomy simplifies the problem very greatly and assures a more perfect end result.

The essential anatomy mentioned may be understood by referring to the diagram (Fig. 1). Personally, I find it easier to understand the essential anatomy by looking first at a median section of the perineum extending to the sphincter ani. It will be seen that the perineal body is a roughly pyramidal mass of more or less homogeneous fibromuscular structure, condensed upon its superior and inferior surfaces into a rather easily distinguishable sheet somewhat resembling fascia, which, although they are not true fascial structures, may be so called for convenience. The layer on the vaginal side of the perineal

body may be spoken of as the superior perineal fascia, the one on the vulvar side being the inferior perineal fascia. The

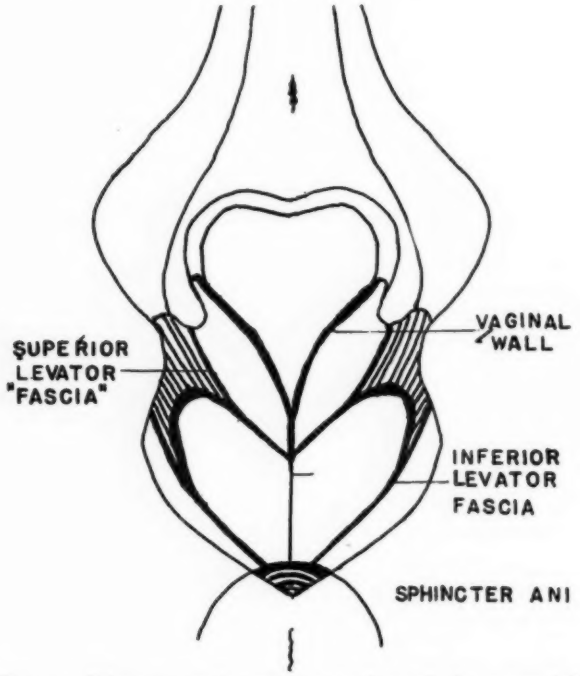

Fig. 1. Diagrammatic representation of the essential structures which must be reapposed to provide a satisfactory repair of the perineum. The heavy lines indicate these structures. The area indicated by the parallel lines represent the retracted levator ani sling. The white area between the superior and inferior fascia is the perineal body. The body and the three layers indicated should be apposed accurately to the same structure of the opposite side. This is essentially the picture presented in median episiotomy.

accurate reunion of these divided fasciae and the reconstruction of the perineal body itself to its original thickness constitute the essential points in repair of the perineum, whether this be done after episiotomy, recent laceration, or old healed laceration.

Referring to Figure 2, an oblique incision such as is made in the mediolateral episiotomy shows these layers of fascia extending laterally to the walls of the pelvis, in this location being spoken of as the inferior and superior levator fasciae; occupying the space between them are the fibers of the vaginal portion of the levator ani muscle. The principles governing repair here are identical with those governing repair of the median episiotomy. However, the operation is more difficult because the transversely severed fibers retract laterally and unequally toward the side of the pelvis and are not so easily reapposed; and the

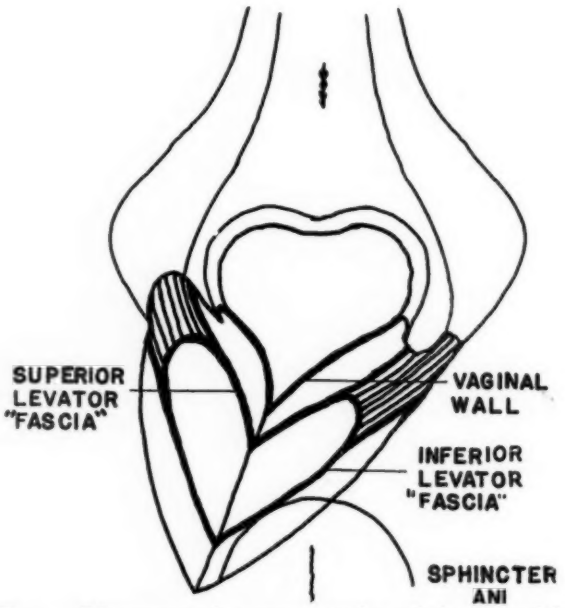

Fig. 2. Diagrammatic representation of the essential structures as they appear in the mediolateral episiotomy. The same simple rules for reapposition obtain here.

end-results are not as satisfactory as in the median episiotomy because transversely severed muscle bundles frequently do not unite well, the gap between them being filled by granulation tissue, which results later in a depressed scar. The mediolateral incision, which is the most universally applicable of the three types, passes roughly just medial to the plane along which the levator fibers are attached to the perineal body. In most instances the incision in the mediolateral episiotomy passes within the substance of the perineal body, leaving a sheet of homogeneous fibromuscular tissue attached to the levator, which can easily be reapposed to the perineal body.

Third Degree Lacerations. In third degree lacerations, in addition to the structures involved in the second degree tears, the sphincter ani, and to a greater or lesser extent the wall of the rectum and the anal canal, are involved. If the sphincter alone is torn leaving the anorectal walls intact,

the first step in repair consists of the reapposition of the severed ends of the sphincter. If the walls of the anal canal and rectum are torn through they must be repaired according to the principles of intestinal surgery before proceeding with the rest of the operation. Such lacerations involve some risk of infection through seepage of the intestinal flora into the deeper parts of the wound.

In most cases of third degree laceration and in a great many cases of second degree laceration the tear extends vertically up the posterior vaginal wall, and may involve the fascia propria of the rectum. This fascia is simply an extension upward of the layer formed by the union of the superior and inferior perineal and levator fasciae. It is the laceration of this structure which is responsible for the type of rectal hernia known as rectocele; and its repair is essential to the prevention of this condition.

When the presenting part begins to distend the perineum, a very good idea of its elasticity may be obtained and a constant watch should be maintained for the evidences of threatened laceration. Some idea of the elasticity of the perineal structures may be obtained by depressing the perineum with the fingers hooked over its anterior edge. However, in a great many cases these structures may be very elastic up to a certain point and totally inelastic beyond this point. The evidences of threatened laceration of the perineum are as follows:

1. The introitus ceases to dilate as rapidly with each contraction as it had done before;

2. The tissues, especially in the midline, become greatly blanched during the height of pressure of the presenting part with each contraction;

3. Serous oozing, resembling beading with sweat, appears upon the skin and mucosa;

4. The epithelium gives way, forming small irregular cracks; next, the deeper structures of the mucosa are involved and the tiny lacerations begin to bleed. Very often this bleeding is not apparent until the pressure is relieved.

The sudden appearance of fresh blood welling up from within as the presenting part recedes indicates a definite beginning tear of the vaginal mucosa. This type of laceration was universally overlooked by the older obstetricians, who considered that they had delivered the patient without laceration if the external perineal mucosa and skin remained intact; in a great many of these cases not only the vaginal mucosa but the underlying fibromuscular structures had given way, creating a second degree laceration which was concealed by the fact that the perineal mucosa and skin had been sufficiently elastic to escape injury.

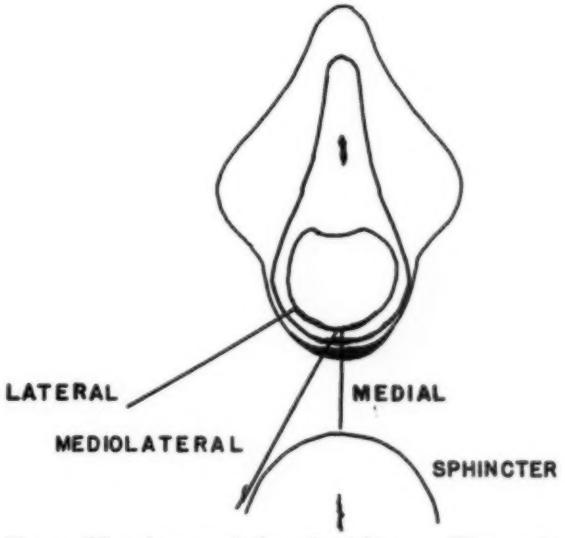

Fig. 3. The three varieties of episiotomy. The angles vary in different individuals: essentially the mediolateral episiotomy should pass just clear of the outer border of the sphincter ani.

Management. In sharp contrast to laceration of the cervix, laceration of the perineum should be avoidable, except in the rare case of precipitate labor of a violence defying prophylactic measures.

There are three procedures which may be employed in the effort to avoid laceration of the perineum:

1. The so-called ironing out of the perineum by manual dilatation. This procedure is being employed by a constantly decreasing number of obstetricians because

of the fact that, while the mucosa and skin may be preserved intact by care, extensive laceration of the essential underlying structures may, and often does, occur without being evident at the time.

2. Episiotomy as a routine measure in all cases. This is done by a great many of the best obstetricians. The procedure is unnecessary in approximately 10 per cent of primipara and in a very much higher percentage of multipara, even when episiotomy with proper repair has previously been done.

3. Episiotomy when it becomes apparent that laceration of the perineum is definitely threatened.

There are three types of incision for episiotomy (Fig. 3).

1. *The Median.* This suffices in most cases; it is easy to repair and usually heals quickly, because the only deep structure involved is the homogeneous tissue of the perineal body. Median episiotomy, however, is subject to extension into or through the sphincter ani and the anal canal if the opening provided is not sufficient for the passage of the head. Therefore it should not be employed in patients with abnormally inelastic tissues, or in cases of abnormally large head, of malposition, of extraction of the aftercoming head, or of narrow transverse outlet (in which case the head must be delivered farther back than is usual).

2. *The Mediolateral.* This is the most universally applicable type of operation. The incision starts at the center of the fourchette and is so planned as to pass just external to the lateral edge of the sphincter ani. In most cases this will keep the greater part of the division of tissue within the substance of the perineal body, especially if the perineal body has been somewhat stretched before the episiotomy is made.

3. *Lateral Episiotomy.* The incision starts at the lower lateral corner (so to speak) of the introitus, and proceeds downward and backward at an angle of 40 to 50 degrees. The objection to the operation is that it divides the fibers of the levator sling transversely. The fibers of voluntary muscle are notoriously difficult to approximate and are not apt to unite without excessive formation of scar tissue.

The repair of episiotomy, or of laceration of the perineum, need not necessarily follow any definite technique, provided that certain essential points be observed:

1. Repair of the wound in the vaginal wall;

2. Reconstruction of the perineal body to its original thickness, which can hardly be accomplished except through the employment of at least two layers of approximating sutures. The use of a single layer of through and through sutures results in a pinching of the tissues at each side of the wound into a permanent thin scar which is unsatisfactory.

3. The repair of the superficial skin and mucosa of the perineum.

4. Observance of the principle mentioned in regard to repair of the cervix: that the sutures should not be placed so close together nor drawn so tight as to interfere with the circulation to the approximated surfaces.

5. It is better, but not essential, to place the sutures so as to cause an approximation of the various layers of the wound, thus eliminating dead space in which blood and serum may accumulate and give rise to abscess formation.

SUMMARY

This article is merely an effort to indicate the most essential points in the recognition and management of the various types of birth injuries. Through observation of such principles the mortality rates can be materially reduced.

POSTPARTUM HEMORRHAGE*

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POSTPARTUM hemorrhage is still one of the greatest causes of maternal mortality and morbidity in this country. Excessive bleeding following delivery is associated so intimately with the management of the third stage of labor that it is impossible to discuss postpartum hemorrhage adequately without some consideration of the physiology and management of the placental stage.

We often think of postpartum hemorrhage as a distinct entity, forgetting that with few exceptions the same causes producing the hemorrhage are present in every delivery. These may be exaggerated to such an extent that the patient sustains an excessive blood loss. The best safeguard, therefore, in the prevention and treatment of hemorrhage is an intelligent understanding of the physiology and management of the third stage of labor. This has been sadly neglected in the training of students and internes. We have felt that hemorrhage was a necessary evil, and that when it did occur it was undoubtedly due to atony of the uterus over which we had no control.

What constitutes a postpartum hemorrhage? In the past we have answered this by stating that 500, 600, or even 800 c.c. should be the dividing line between normal and abnormal bleeding. Such an arbitrary division is of no value as far as the treatment and prognosis of the patient is concerned, and is useful only for statistical purposes. Recently I have shown that a more accurate method would be to express the blood loss in terms of the body weight, or indirectly in terms of the blood volume of the patient, assuming that the blood volume is proportional to the body weight. On this basis then, 1.0 per cent blood loss would be equivalent to 600 c.c. in the average patient weighing 60 Kg., or to 800 c.c. in the patient weighing 80 Kg. The value of this method will be explained in detail when we discuss the treatment of the patient.

Does this tell the complete story about any one patient? Certainly not, for we have failed to take into consideration the condition of the patient prior to delivery. To be unaware of the patient's hemoglobin, cell volume, or red blood count is as much an evidence of negligence as to have failed to measure the pelvis before labor. If antepartum care is to be of any value to the patient, then it should inform us early in pregnancy of the condition of that patient so that we will be prepared for any eventuality which might occur at the time of delivery. One determination of hemoglobin or cell volume is not sufficient, for we have a long interval during which time anemia may develop. This is particularly true because of the hydremia which occurs during pregnancy. Yet, it is surprising to note the number of patients who come to delivery without even a single hemoglobin determination ever having been made. Are we fulfilling our duty to the patient under such conditions?

Another prerequisite for the correct evaluation of the effect of the blood loss on the patient is the accurate measurement of the blood loss. It is unnecessary for me to repeat that estimations of blood losses are erroneous, and therefore the conclusions drawn from them are likewise inaccurate. The new method[8] used in this clinic for the past thirty months has been found to be

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entirely satisfactory. We prefer it to the other methods because of its simplicity. It acquaints us with the extent of the blood

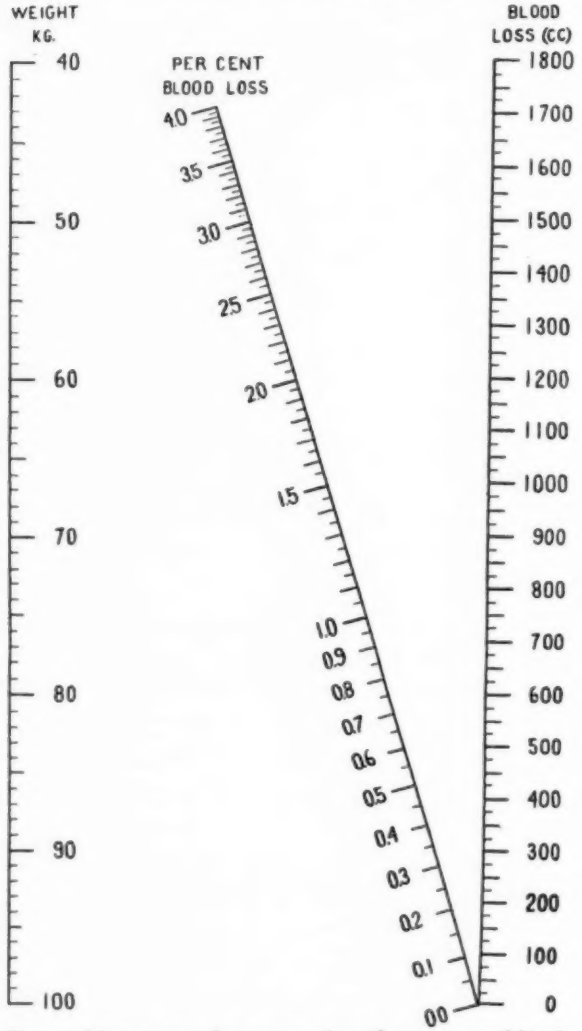

FIG. 1. Nomogram for computing the per cent blood loss. Draw a straight line between any two known points to obtain the third value. (Use transparent ruler.)

loss at any given time, and the amount lost in each of the three phases of the third stage is available immediately. This is necessary not only for the proper conduct of the third stage of labor, but also for the correct evaluation of the cause of the hemorrhage. How else can we make progress in the reduction of postpartum hemorrhage than by the determination and elimination of its causes? If atony alone were the usual cause, postpartum hemorrhage would have been reduced long ago by the introduction of the various oxytocics. To my knowledge such a reduction in the incidence of postpartum hemorrhage, and consequently of maternal morbidity and mortality, has not taken place during the last decade.

From what has already been said, it can be seen that each case should be considered individually. Whether a particular patient has a hemorrhage or not is actually only of academic interest. The real problem is: Can that patient withstand the blood loss with impunity as regards to the immediate danger and the ultimate morbidity?

THE THIRD STAGE OF LABOR

Space does not permit me to present our present knowledge of the anatomical development and attachment of the placenta. For our purpose it will suffice to discuss only the separation and expression of the placenta. In the past too much emphasis has been placed on the "laissez faire" attitude of treating the placental stage. I fully agree that the expression of the placenta should not be hastened unnecessarily, but I am also convinced that delay in expressing a separated placenta leads to further bleeding and atony of the uterus.

Separation of the placenta is purely a mechanical process due to the contraction and retraction of the uterus. For this reason we must appreciate that the retroplacental hematoma is not the cause of separation but rather the result of the detachment of the placenta. A small hematoma, of course, is present in the Schultze mechanism of separation, but should never be present when the placenta presents by the Duncan mechanism. If a large hematoma is present in either case, it is indicative of delayed expression, that is, the placenta was separated and in the lower uterine segment, cervix or vagina for some time before it was expressed. How then can we determine when separation has occurred, since most of the textbooks speak of separation only after the placenta has descended into the vagina?

To Calkins[3] should be given the credit for clarifying this issue. By his method the

change in shape of the fundus is the most important sign. When the uterus changes from a discoid to a globular shape separa-

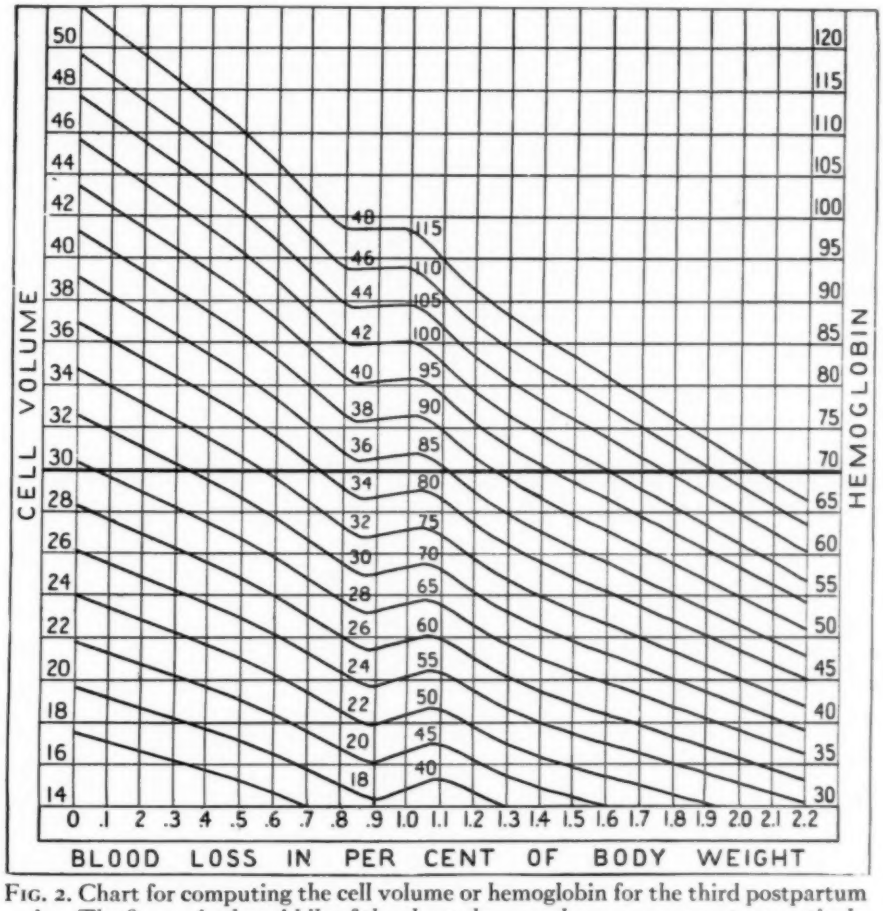

FIG. 2. Chart for computing the cell volume or hemoglobin for the third postpartum day. The figures in the middle of the chart above each curve represent respectively the cell volume and hemoglobin before delivery. The values at the left and right of the graph are for the third postpartum day. (See text for directions.)

tion has occurred and the placenta should be expressed. The rise of the fundus in the abdomen is really a sign of descent rather than of separation of the placenta. We have used this method in our clinic for the past two years and agree with Calkins that the third stage is much shorter than was suspected formerly, and that the size of the retroplacental hematoma has been decreased markedly. The average duration of the third stage has been from five to seven minutes. In our clinic, in 1870 consecutive deliveries of full term and premature infants the average blood loss was 271.3 c.c. with 7.11 per cent of the patients having a blood loss of 600 c.c. or more. These include only the cases in which the blood loss was measured accurately, even the estimated blood losses of less than 50 c.c. have been excluded. These figures are somewhat higher than those previously reported, but when we take into consideration the per cent blood loss rather than the actual volume lost, we find that the results are comparable. In this present series only 5.28 per cent of the patients had a blood loss of 1.0 per cent or more and the average per cent blood loss was 0.381. This compares favorably with the previous series with 5.4 per cent of the cases having a blood loss of 1.0 per cent or more and an average per cent loss of 0.353. The value of expressing the blood loss in terms of the body weight is therefore obvious, and the information obtained by this method becomes valuable in the treatment of the patient.

In 1936 I[9] strongly opposed the use of the fundus as a piston in the expression of the placenta because of the unnecessary trauma exerted on the fundus and because the uterus was usually pushed deep into the pelvis. Both of these factors increase bleeding following the expression of the placenta. To prevent this the management of the third stage of labor should be conducted by an assistant. Immediately following the delivery of the child, the right hand of the assistant is placed over the top of the fundus with the thumb over the anterior and the fingers over the posterior surface of the uterus. When the placenta is separated the fundus is gently massaged or, if there is no bleeding from the uterus, it is left alone until a contraction occurs spontaneously. At this time the left hand of the assistant is placed flat over the abdomen with the fingers directed under the symphysis. The fundus is then squeezed and pushed downwards with the right hand. The left hand prevents the fundus from entering the pelvis, and the placenta can be felt passing through the lower uterine segment and cervix. While the cord is held by the operator the uterus is lifted up by the assistant and held at about the level of the umbilicus. In this way any portion of the placenta still in the cervix becomes free in the vagina. The placenta is then extracted by the operator by traction on the cord. There can be no danger of inversion of the uterus by this method because the placenta is definitely in the vagina before traction is applied. This is different from "pulling on the cord" while the placenta is still adherent. In so conducting the expression unnecessary trauma to the uterus is eliminated and also the fundus is prevented from entering the pelvis, both of which are necessary to reduce bleeding.

There are many factors during labor and delivery which increase the normal amount of bleeding. These factors are usually those which tend to produce atony following delivery. The most important of these are analgesia and anesthesia. Too little attention has been paid to this source of bleeding, but it is quite evident that analgesia in the form of rectal ether does increase bleeding. Operative delivery also increases the blood loss. This may of course be due to injury to the birth canal, but in the majority of cases it is due to the anesthesia which was necessary for the operative procedure. Local anesthesia in the average delivery has been recommended frequently. Although I have had no personal experience with this form of anesthesia, the reports are very convincing and it deserves further investigation.

The use of pituitary extracts prior to the delivery of the placenta has been a debatable question for many years. I fully agree with Moir that in the average case oxytocics are not necessary. However, in this age of hospitalization and the frequent use of analgesia and anesthesia, it seems reasonable that some stimulant is required. Since January, 1936 we have been employing 1 c.c. of obstetrical pituitrin immediately following the delivery of the baby. With such a practice we have not noted any increase in the incidence of manual removal of the placenta, an objection which has always been brought forth when its use was suggested. If the proper management of the third stage of labor is practiced, the placenta will usually be expressed before the action of the pituitrin takes place. In addition, even if the third stage is prolonged, there is no reason to suspect that the placenta would become incarcerated unless there was some obstruction to its expulsion. For hospital practice, particularly when analgesia and anesthesia are employed, the use of pituitrin immediately following the birth of the child seems to be indicated. In our own experience no harm has been done, and the degree of atony immediately following the expression of the placenta has been decreased markedly.

POSTPARTUM HEMORRHAGE

A blood loss to 600 c.c. or more is usually considered a postpartum hemorrhage. The extent of the hemorrhage may range from 600 c.c. to 3500 c.c., and there have been

numerous reports of cases with blood losses of 2500 to 3000 c.c. without fatalities. However, one wonders if it is ever necessary for any patient to sustain a loss greater than 1500 c.c. except in the rare cases of rupture of the uterus, inversion of the uterus, or concealed bleeding into the broad ligaments. A loss greater than 1500 c.c. should not occur if we are trained to handle postpartum hemorrhage and if we are aware of the extent of the bleeding at the time that it occurs. In our own experience, in the two year period prior to our present method of measuring the blood loss, there were 13 cases with a blood loss of 1500 c.c. or more, 3 of these being above 2000 c.c. Since then there have been only 3 cases, the largest blood loss being 1650 c.c., in a series of 2370 cases already studied. In other words, at the present time a blood loss of 1500 c.c. or more occurs in only 1.3 per cent of all the hemorrhages in contrast to 7.2 per cent for the period prior to September, 1934.

The essential factor in the treatment of postpartum hemorrhage is the early recognition and elimination of its cause. This can be done if a definite routine is used. The statement that atony is the usual cause of hemorrhage is misleading, and directs one's attention away from the actual source of bleeding. The best method for early recognition of the source of bleeding is to follow the third stage in its chronological order. For that purpose we divide the third stage into three phases, and the causes of bleeding in each of these will be discussed separately.

1. *Period from the Time of Delivery of the Infant to the Separation of the Placenta.* There are three main causes of bleeding during this period, and if the physician directs his attention to the mother rather than to the baby the amount of bleeding can be reduced greatly. The care of the infant can either be postponed or entrusted to an assistant.

A. Perineal or vaginal lacerations.

Simple inspection will reveal the source of bleeding in the perineum or vagina. Needless to say, repair should be performed immediately. Profuse bleeding can be reduced by placing the muscle sutures first, even though approximation of the mucosa may be a little more difficult. The amount of bleeding varies with the extent of the laceration or episiotomy. A constant although slight trickle of blood will amount to several hundred cubic centimeters if neglected. Speed is essential not only to reduce bleeding but also to decrease the amount of anesthesia necessary. We too often fail to realize that anesthesia will ultimately produce atony of the uterus. It is in this field that local anesthesia would be most beneficial. In a few cases, ruptured varicosities may be the cause of bleeding, and in these cases it is futile to attempt to control the bleeding with sutures. The treatment for ruptured varicosities will be discussed later.

B. Cervical lacerations.

Cervical lacerations should be suspected when any operative procedure is done without full dilatation of the cervix. However it is not necessary to inspect every cervix as has been recommended recently. This practice will increase not only the incidence of infection but also the extent of bleeding, because the uterus has to be pushed deep into the vagina for visualization. Clinically the picture is characteristic and should not be confused with any other cause. The bleeding is bright red or arterial in origin, and is of the spurting type. It is distinctly different from uterine bleeding which is venous in origin, continuous in its flow, and subject to uterine contractions. In our own experience cervical lacerations were responsible for bleeding in only 9 cases in a series of 2370 vaginal deliveries. Why then should we inspect every cervix? Why not acquaint ourselves with the clinical picture? The treatment will be discussed later.

C. Uterine bleeding due to partial separation of the placenta.

From our knowledge of the separation of the placenta it can be seen that bleeding from the uterus during this period is due to the Duncan mechanism of separation. A Schultze mechanism will not bleed until

complete separation has occurred and then the blood loss is usually following the expression. It is interesting to note that there is a higher incidence of Duncan presentation with operative delivery. What role anesthesia plays in this respect is difficult to say, but it seems to be responsible in some way. Contrary to most teaching, shortening the third stage of labor does not necessarily increase the incidence of Duncan presentation of the placenta. Our incidence of this form of presentation is no greater now than it was formerly, even compared with the large statistics available on the subject. The reason for this is that separation is recognized early with our present method. No attempt at expression is made unless the placenta is separated.

The treatment of this condition of course depends on the extent of the bleeding. If slight we can wait until complete separation occurs. However, if the bleeding is reaching the proportion of a hemorrhage, then the Credé method is attempted. This, unfortunately, is not successful in many of the cases and more drastic measures become necessary. It may well be that some of these cases are due to partial placenta accreta, and that should be borne in mind when manual removal of the placenta is undertaken. The indication for mnaual removal of the placenta will vary with the individual case, and depends on the extent of the hemorrhage, the condition of the patient, and the facilities available at the time. If carried out under strict aseptic conditions in a well organized hospital, bad results occur only when the blood loss approaches fatal proportions. Needless to say, manual removal of the placenta should be done carefully and with the ulnar edge of the hand. Also it is better to carry out the dissection from above downwards than in the reverse order. The amount of bleeding is less, the uterus can contract down over the hand, and the danger of perforation is diminished. There is usually no necessity for tamponade of the uterus following manual removal of the placenta. The fundus contracts firmly and the bleeding ceases. If atony does exist, then the treatment for this condition should be instituted immediately.

II. *Period from the Time of Separation of the Placenta to the Completion of the Expression.* This is truly the period of mismanagement of the third stage of labor, and with training the patient will be spared excessive blood loss.

A. Delayed expression of a separated placenta.

Large amounts of clots behind the placenta is indicative of delayed expression. Blood accumulates after the placenta has descended into the cervix or vagina and allowed to remain there for some time. The uterus is unable to contract down firmly and consequently concealed bleeding occurs. This is mismanagement if we fail to recognize separation of the placenta or fail to express it when the diagnosis is made. Many obstetricians prefer to wait until the perineal repair is completed before expressing the placenta. This is a very poor practice and is entirely at the expense of the patient. A few seconds delay in the repair will do no harm and may save the patient a considerable amount of blood. With the method of Calkins, which I have outlined already, the occurrence of this type of bleeding is rare, except in the few cases of obesity and distress from anesthesia, where the proper procedure cannot be followed. Very little can be done for this type of bleeding when it does occur; our attention should be directed entirely towards its prevention. If you wait for the rise of the fundus in the abdomen you will continue to have large retroplacental hematomas. The placenta should be expressed when it is separated, regardless of the duration of the third stage.

B. Faulty expression of the placenta.

We have all noticed that in some cases there is fresh bleeding under great tension during the expression of the placenta. Is it possible that a normal uterine contraction can be so powerful? Indeed not. It is the use of the fundus as a piston which is responsible, causing unnecessary pressure

and congestion of the uterus. This is not necessary if the proper method of expression is used. When we assume the duty of assisting the patient in expelling the placenta we should be as gentle as Nature herself. Here again prevention rather than treatment of this type of bleeding is the essential factor. The author's method of expression has already been described.

III. *The Period Following the Expression of the Placenta.* If the third stage of labor has been conducted as outlined, then the assistant and the operator can cooperate in the early recognition of the source of bleeding during this period. In the average case there are four possible causes of bleeding. Those associated with other abnormalities will be discussed separately although they can be ruled out in the following routine.

A. Atony of the uterus.

Following delivery of the placenta the assistant holds the fundus out of the pelvis and is in a position to recognize early any evidence of atony of the uterus. Bleeding from this source is venous in type, and is subject to uterine contractions. If atony is present it should be treated immediately. When the bleeding is slight mild massage of the fundus is sufficient to cause a contraction and to control the bleeding. However, in the usual case more profuse bleeding is present and stimulants become necessary. It must be remembered that even the newer ergot preparations require from four to seven minutes to act when given intramuscularly. For that reason intravenous therapy is necessary if prompt results are desired. Pituitrin can be given intravenously, but in our experience pituitrin reactions were observed in about 5 per cent of the cases, and for that reason we are now employing an equivalent amount of pitocin which is protein free. Since January, 1936 no reactions have been noted with the use of pitocin, and its action is as good as that of pituitrin. Three minims, diluted in 2.5 c.c. of normal saline, are used. This dilution is necessary to permit slow administration, forty to fifty seconds being required. The action is strong and usually takes place within ten seconds. In our own clinic this solution is always available and ready for use. It is prepared by adding 2 c.c. of pitocin to 23 c.c. of normal saline. The solution is then placed in a sterile vaccine bottle and the required amount can be withdrawn with ease. No deterioration has been noted. If pitocin is used intravenously with good contraction and the bleeding is unabated, then the cause of bleeding is not atony of the uterus and no time should be lost in determining the cause. If for no other reason, pitocin intravenously can be used for diagnostic purposes, and is therefore of great value. One of the newer ergot preparations should be given subsequent to this to obtain a more prolonged action. When pituitrin or pitocin is used intravenously, packing of the uterus becomes unnecessary except in the few abnormalities which will be discussed later. Tamponade was necessary in only 4 cases in the last 1870 deliveries studied. It is with the hope of eliminating the atony immediately following the expression of the placenta that we are employing pituitrin following the delivery of the infant. Some good results have already been noted.

B. Prolapse of the fundus into the pelvis.

This type of bleeding is very alarming because it is profuse and continuous in its flow and not subject to uterine contractions. With the patient in the lithotomy position very little pressure is necessary to push the fundus into the pelvis. This causes obstruction to the venous drainage of the uterus with subsequent overflow through the maternal sinuses. It is analogous to the congestion found in marked retroversion of the uterus in the non-pregnant woman. As already pointed out, it should be prevented, and if it does occur it can be corrected immediately. This can be done by grasping the fundus with two hands and lifting it up into the abdomen. In a few cases the fundus may be so deep that pressure on the cervix is necessary to raise the uterus. When the patient is flat on the table it is not necessary to hold the fundus up.

C. Perineal and vaginal lacerations.

The treatment of this source of bleeding has already been discussed. Many physicians are in the habit of placing sponges in the vagina during the repair. Such a practice is mentioned only to be condemned because its use prevents the accurate measurement of the blood loss. If bleeding from the uterus is of such proportions that it interferes with the repair, then we should determine its cause and eliminate it immediately.

In some cases bleeding from lacerations may be confused with uterine bleeding, but careful inspection will usually reveal some extension into the vaginal vault or ruptured varicosities. Ruptured varicosities present a more difficult problem since repair may lead to increased bleeding. In these cases packing the vagina is indicated. However, it must be remembered that such a procedure obscures the only external sign which we have of uterine bleeding, and for that reason the uterus should be diligently watched for several hours for evidence of uterine atony and concealed bleeding. We have had one unfortunate experience during the past year with this form of treatment. The uterus became boggy and there was concealed bleeding which was not recognized until the patient went into shock. At that time the packing was removed and 1000 c.c. of clots were expressed. In spite of tamponade of the uterus and repeated transfusions the patient died on the fourth day from puerperal infection. The vaginal packing can be removed with safety after twelve to twenty-four hours. It should be stressed here that vaginal packing is indicated only in cases of ruptured varicosities and deep extensions of lacerations which cannot be repaired. It should never be used in the face of uterine bleeding.

D. Cervical lacerations.

In a few cases cervical lacerations may not bleed until the placenta is expressed. Following delivery and the collapse of the lower uterine segment and cervix, clots may form and prevent cervical bleeding. However, with the expulsion of the placenta the clots are brushed away and fresh bleeding may ensue. The bleeding is characteristic and the cervix can be quickly exposed and repaired. One suture should be placed well above the apex of the laceration to control the bleeding. Other sutures are necessary only to approximate the cut edges. Bleeding can be controlled by compression of the apex of the laceration with the fingers while the sutures are being prepared. Careful attention to asepsis is absolutely essential in the prevention of infection.

E. Special abnormalities.

Many of these abnormalities are recognized even before delivery, and their possible role in the causation of hemorrhage should be borne in mind.

1. Placenta previa.

Bleeding due to this abnormality may occur immediately following the delivery of the infant. The bleeding is due to partial separation of the placenta and the same treatment can be instituted. Manual removal of the placenta should not be done unless there is excessive bleeding. The indication for this procedure is the same as that described under partial separation of the placenta. More frequently the bleeding follows the expression of the placenta. Such bleeding is essentially due to atony of the lower uterine segment. Because of the implantation of the placenta over this non-contractile portion of the uterus, bleeding may continue in spite of a well contracted fundus. Even pituitrin or pitocin intravenously is of no avail in these cases, and the only treatment is packing of the uterus with sufficient gauze to give satisfactory pressure over the placental site. Tamponade of the uterus can be carried out with reasonable asepsis with the use of the Holmes packer, and the packing can be left in situ for twenty-four hours. It is advisable to remove the packing in two stages and to be prepared to repack the uterus if necessary. Oxytocics during the removal of the packing are beneficial.

2. Premature separation of the placenta.

As a rule the placenta is completely separated and expressed immediately following delivery. The uterus contracts down firmly and there is surprisingly little bleeding following the expression of the placenta. However, in a few cases there may be profuse bleeding from the uterus in spite of a firm fundus. These cases are possibly due to infiltration of the uterine muscle with blood and subsequent paralysis of the uterine musculature. The uterus remains firm and, even if pituitrin or pitocin is given intravenously, the bleeding continues. This is actually a mechanical atony or lack of constriction of the maternal sinuses. Packing of the uterus should be done immediately and large amounts of gauze are necessary because the uterus has a tendency to distend rather than to retract. In some cases the uterus will continue to distend and bleed, and abdominal hysterectomy becomes necessary. For that reason the uterus should be watched carefully for evidence of concealed bleeding after it has been packed. Although this condition is noticed more frequently in the severe cases of premature separation of the placenta which are treated by cesarean section, it can occur in even the mild cases where vaginal delivery is performed. During the past year we have had one case with fatal results before a hysterectomy could be done.

3. Myomata uteri.

There is considerable variation in the blood loss with the different types of myomata of the uterus. Usually the subserous type offers no special difficulty during the third stage. But the submucous and intramural forms may increase bleeding, depending on their location in respect to the implantation of the placenta. The cause of bleeding is again mechanical in that the myomatous nodule prevents the uterus from contracting firmly enough to occlude the maternal sinuses. Pitocin intravenously may be of no avail in these cases, and the bleeding persists in the face of strong tetanic contractions. Here again the treatment of choice is tamponade of the uterus. This procedure is not indicated in all cases of myomata of the uterus unless there is excessive bleeding.

4. Retained placental tissue.

Small portions of placenta, when retained, offer no immediate problem, since bleeding usually occurs during the puerperium. However, if large portions or succenturiate lobes are retained, considerable bleeding may ensue. Careful examination at the time of delivery is essential, and succenturiate lobes can be suspected if torn vessels are noticed in the membranes. These should be removed manually, for even though there may not be any bleeding, the incidence of puerperal infection is markedly increased, and manual removal at the time when infection is present is indeed a hazarduous procedure. Retained placental tissue is not a frequent cause of postpartum hemorrhage. If the entire placenta is retained, at least one hour should elapse before manual removal is undertaken unless there is excessive bleeding.

5. Inversion of the uterus.

Fortunately this condition is rare, having occurred three times in 12,000 deliveries in this clinic. For complete discussion the reader is referred to the special papers[6,15] on the subject. Suffice it to say, that, with very few exceptions, inversion of the uterus is due to faulty management of the third stage of labor. Attempts at expression should be mild and not forceful. As previously stated, partial placenta accreta may be responsible for partial separation of the placenta, and if too great a force is applied, inversion can occur. A recent case illustrates this particularly well. The patient had had two previous deliveries and manual removal of the placenta was necessary in each case. At her third delivery there was some difficulty in expressing the placenta. With slight pressure on the fundus the placenta appeared at the outlet, but part of it was still adherent to the uterine wall which had been inverted. Fortunately this was reduced without difficulty. Reduction should be attempted in every case of acute

inversion. With the use of 7 minims of adrenalin and deep anesthesia replacement is possible in many of the cases. In other cases it is necessary to employ either the Huntington or Haultain operation to correct the inversion. Pressure around the lower segment of the uterus can be applied while preparations for operation are made. This contricts the uterine vessels and thus diminishes the bleeding.

6. Placenta accreta.

This condition is exceedingly rare and should be diagnosed without difficulty. There is invasion of the uterine musculature by the chorionic villi so that no plane of cleavage is present. With complete attachment of the placenta to the uterine wall there is no bleeding. Retained placenta with no uterine bleeding should make one suspicious of this condition. Bleeding usually begins when attempts at manual removal are made. Perforation of the uterine wall results from unwarranted attempts to separate the placenta. Hysterectomy is the only treatment which offers a good prognosis. This should not be delayed after the diagnosis has been made, because of the danger of infection.

7. Rupture of the uterus.

For a statistical study of rupture of the uterus the reader is referred to the paper of Davis.[4] For our own purpose we are interested only in the cases of rupture during delivery, either by version or by difficult forceps delivery. Following difficult delivery, exploration of the uterus is indicated, for the signs and symptoms of rupture of the uterus may not develop until it is too late for treatment. In most of these cases laparotomy is indicated, although in some cases packing of the uterus may control the bleeding and repair may be postponed. If laparotomy is performed, one of two procedures can be carried out. When the rupture is clean cut and without bleeding into the broad ligaments, repair is permissible, especially if tubal sterilization is performed at the same time. In the majority of cases, however, hysterectomy is the treatment of choice. This should be done as rapidly as is feasible to prevent additional trauma to the patient. The incidence of rupture of the uterus during delivery will be reduced greatly if operative delivery is done only when indicated and in a well organized hospital. The home is not the place for difficult deliveries.

Many methods and instruments have been devised to combat bleeding following the third stage of labor. It should be remembered that most of these are of temporary value only, and are not directed towards the cause of bleeding. They may prove to be of some value as an emergency measure until operative procedure can be accomplished. The various methods of compressing the aorta were designed for this purpose. Henkel's clamps for compressing the broad ligaments may do more harm than good, and I doubt if they should ever be used. If the proper attention is directed towards the third stage of labor, bleeding will be controlled before such methods becomes necessary. Intelligent management of every case cannot be replaced by mechanical devices.

Attention to the general condition of the patient is necessary following a hemorrhage. The incidence of shock in these patients is low. In our own experience this incidence has been greatly reduced with the establishment of our present method of measuring the blood loss. This is either due to a better management of the third stage or to an actual reduction in the amount of blood loss. In the presence of shock intravenous glucose and gum acacia are beneficial, but it should be remembered that the cause of bleeding must be eliminated before artificial means are used to raise the blood pressure. If this is neglected, secondary bleeding with more profound shock will ensue. It is of the greatest importance to avoid any procedure which will add insult to an already injured patient. The use of transfusions will be discussed separately.

THE ROLE OF TRANSFUSION IN THE PREVENTION OF POSTPARTUM INFECTION AND ANEMIA

It has been known for a long time that postpartum hemorrhage predisposes the patient to puerperal infection. If this is true, then the increased incidence of infection is due either to a marked drop in hemoglobin or else to the presence of anemia. In either case the logical treatment would be replacement of the blood loss. In the past we have been unable to predict the drop in hemoglobin following a known blood loss. For that reason our treatment was delayed until the third postpartum day when a hemoglobin determination was done.

A recent study[11] conducted in our clinic has shown that variations in response to blood loss was apparent rather than real. If the blood loss is expressed in terms of the body weight, or indirectly in terms of the blood volume, there is a definite correlation between the drop in hemoglobin or cell volume and the blood loss. For details regarding this study the reader is referred to a previous paper. Suffice it to say, that with the exception of the cases of toxemia of pregnancy, the status of the blood on the third postpartum day can be calculated at the time of delivery.

It was found in this study that cell volume determinations were much more accurate than the ordinary hemoglobin determination, and for that reason cell volume readings are preferred. The incidence of infection was found not only to increase with the blood loss, but more specifically with the decrease in the patient's cell volume on the third day. All patients who had a cell volume of 40 per cent or more on the third postpartum day had an incidence of infection (including all infections) of 4.5 per cent, while those with a cell volume between 30 per cent and 40 per cent had infection in 7.5 per cent of the cases, and those whose cell volume dropped below 30 per cent had an infection rate of 31.0 per cent. This was true not only for the patients who had a hemorrhage, but also for those who had such a low cell volume before delivery that even a small blood loss was sufficient to cause it to drop below 30 per cent.

On this basis then, those patients who have a cell volume of less than 30 per cent on the third postpartum day should receive a transfusion immediately after delivery. This is the plan which we are now using in an effort to reduce puerperal infection and to prevent secondary anemia during the puerperium. To facilitate this we employ the two charts shown in Figures 1 and 2. With the use of the nomogram in Figure 1 it is a simple procedure to determine the blood loss in terms of the body weight. A straight line drawn between the weight of the patient, represented on the scale on the left, and the measured blood loss on the right, will cross the middle scale which represents the loss in per cent of the body weight. Having obtained this we can proceed to determine what the cell volume will be on the third postpartum day, providing that we know the cell volume or hemoglobin before delivery. This is done by employing the graph in Figure 2. The figures above each curve in the middle of the chart represent respectively the cell volume and hemoglobin before delivery. By following the curve up or down until it crosses the vertical line representing the per cent blood loss, and reading to the left for cell volume and to the right for hemoglobin, the value for the third day is obtained. If the point of intersection is below the heavy horizontal line, which represents a cell volume of 30 per cent, then the patient receives a transfusion immediately following delivery. We give all these patients 500 c.c. of citrated blood unless they require more than this amount. From the chart in Figure 2, the actual amount of blood necessary to maintain the cell volume above 30 per cent can be determined. By following any curve, representing the cell volume before delivery, until it crosses the heavy horizontal line, the maximum amount of blood which

that patient can lose before her cell volume drops into the critical range, is determined. The difference between this value and the actual per cent blood loss is the per cent of blood loss which should be replaced. By using the nomogram (Fig. 1) the actual volume of blood in cubic centimeters can be determined. As stated already we make no attempt at giving the actual amount necessary except to be certain that 500 c.c. are sufficient. If we give more than is necessary the cell volume will be even higher than 30 per cent and the incidence of infection would be even lower. It should be definitely stated here that the chart is not to be used for interpolating hemoglobin values from the cell volume figures or vice versa. Both the cell volume and hemoglobin figures are placed on the same chart for convenience only. If hemoglobin determinations are used they should be accurate figures obtained by the oxygen method of Van Slyke. The ordinary determinations made by the Sahli method are inaccurate especially when done by different individuals.

We employ citrated blood in preference to whole blood because of the ease of administration. There has been no definite proof that whole blood is superior for this purpose. I can readily understand that in some cases where hemorrhage is due to blood dyscrasia whole blood may be better, but for simple replacement of blood loss, the citrate method is convenient, easy and safe for the patient and donor.

This prophylactic use of transfusion should decrease not only postpartum infection towards the base line of 4.5 per cent but also the number of days of hospitalization following delivery, and should eliminate completely the presence of secondary anemia during the puerperium. This method does not necessarily increase the number of transfusions. It simply means that we give the transfusion immediately after delivery instead of late in the puerperium when infection is also present. It also shows the value of knowing what the status of the blood is during pregnancy. For if we follow this carefully during the antenatal course we will recognize early those patients with a low hemoglobin or cell volume and institute measures to improve it. The higher the cell volume at the time of delivery the safer is it for the patient to endure complications of labor, delivery and puerperium; remembering that even a small blood loss may be dangerous to the patient with a low hemoglobin or cell volume, even though it is not below the average figure for normal.

SUMMARY

It is almost impossible to define postpartum hemorrhage since it is an individual problem. What is a normal blood loss for one patient may prove to be a serious loss for another. The condition of the patient before delivery is as important as the actual blood loss. For practical purposes it is best to express the blood loss in terms of the body weight since the effect of any blood loss is inversely proportional to the total blood volume. For statistical purposes one (1.0) per cent or more blood loss is indicative of postpartum hemorrhage. This is far more accurate than the actual volume lost because it takes into consideration the weight of the patient.

Following each delivery we should ask ourselves: Can this patient withstand the blood loss with impunity? We have found that the incidence of postpartum infection increases 400 per cent if the cell volume drops below 30 per cent during the puerperium. We can maintain the cell volume above this level in three different ways:

1. By maintaining as high a cell volume before delivery as is possible so that it will remain above 30 per cent even in spite of a large blood loss. In some cases it may mean a transfusion during the antenatal course. In all cases it means careful study of the blood during the prenatal course.

2. By decreasing the average blood loss during the third stage of labor. Many drugs now used for analgesia and anesthesia should be replaced because of their relaxing effect on the uterus. Because of the fre-

quent use of these drugs in most hospitals stimulants become necessary and have been recommended freely in this paper. Intelligent understanding of the third stage of labor will reduce hemorrhage due to mismanagement. Early recognition and treatment of the cause of hemorrhage will also reduce blood loss. Our management of the third stage as well as our method of measuring the blood loss have been described.

3. By replacement of blood loss by transfusion in cases where the cell volume would drop below 30 per cent. This can be done with the use of the charts shown in Figures 1 and 2. The patient should be returned to society in as good a condition as when she came to us for care. The presence of anemia is as much an index of negligence as the presence of anatomical defect due to faulty delivery.

Finally I wish to express my sincere appreciation to the guest editor, Dr. H. J. Stander, for the privilege of presenting my views on postpartum hemorrhage to the medical profession. For the sake of brevity discussion of the works of many investigators has been omitted purposely from the text.

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RETAINED AND ADHERENT PLACENTA

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FOLLOWING the expulsion of the child, the marked diminution in the area of the placental site is accompanied by more or less splitting of the decidua basalis in the region of the stratum spongiosum and, within a short time, complete cleavage in this spongy layer is accomplished. The separated placenta is then forced by the uterine contractions or by a bearing down effort, into the lower birth passages and ultimately is expelled. Interference with this mechanism may therefore lead to its retention. The placenta, accordingly, may be retained in any one of the following circumstances:

1. Absence of a normal decidua with direct attachment of the chorionic elements to the uterine musculature: *adherent and inseparable placenta—placenta accreta.*

2. Failure of the customary decidual cleavage due either to an abnormal decidua, an anatomical defect in the uterus, or to a lack of the normal contraction and retraction in the third stage: *adherent but separable placenta.*

3. Hour-glass contraction of the uterus with imprisonment of the separated placenta within the upper segment: *separated but incarcerated placenta.*

4. Impairment of the forces which normally are responsible for the expulsion of the placenta after it has been separated: *separated but retained placenta.*

A separated but retained placenta occurs rather frequently when the third stage of labor is left entirely to Nature and is encountered most commonly in women with lax abdominal walls who have been greatly fatigued by a prolonged labor. It was in these cases that the midwife formerly brought about the placenta's expulsion by irritating the nasal mucous membrane with a feather to induce sneezing. The forced contractions of the diaphragm and abdominal muscles thus increased the intra-abdominal pressure and effected the delivery of the separated placenta from the lower uterine segment and vagina. Natural expulsion was also favored by the use of a tight abdominal binder or by gathering folds of the relaxed abdominal wall within the grasp of the attendant's hand for the purpose of diminishing the capacity of the abdominal cavity.

About the middle of the eighteenth century, The Dublin School of Midwifery recommended the artificial expulsion of the separated placenta in the manner shown in Figure 1. With the fingers behind and the thumb in front of the uterus, pressure in the axis of the pelvic inlet is exerted on the fundus. The uterus thus is used as a piston and forces the placenta out of the birth canal. This procedure should never be used when the uterus is relaxed. In such circumstances, the latter is gently massaged until it becomes firmly contracted; otherwise, inversion may be favored. Pressure on the fundus as a means of hastening the delivery of the placenta was again advocated by Credé of Leipzig in 1861, after which it became known as Credé's method of expressing the placenta.

While this procedure is accompanied by little or no risk when the placenta is separated but retained within the birth passages, its premature use may cause serious bleeding if complete detachment has not occurred. Artificial expression, accordingly, should not be employed until at least one hour has elapsed after the birth of the child, unless the signs of separation are present,

or unless evidence of increasing hemorrhage is noted. The signs which indicate complete separation of the placenta are:

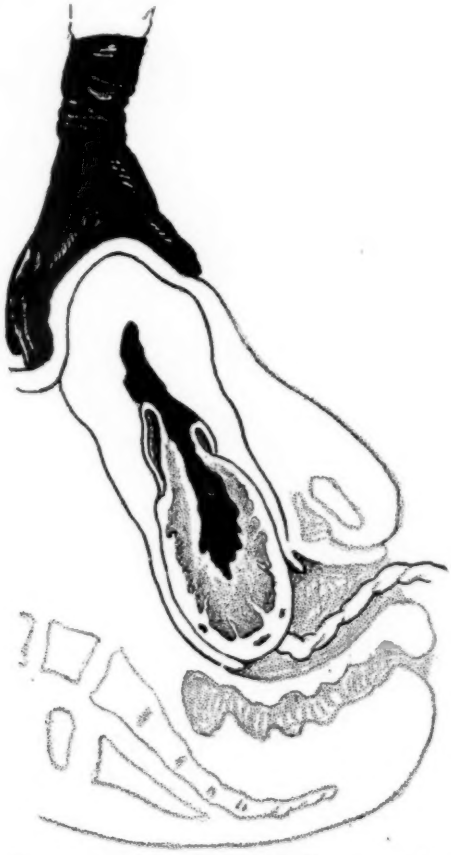

Fig. 1. Method of artificially expressing the placenta after it is separated. With the fingers behind and the thumb in front of the uterus, pressure in the axis of the pelvic inlet is exerted on the fundus, after the signs of separation have appeared. (Beck, Obstetrical Practice, Baltimore, Williams & Wilkins.)

(a) The rising of the fundus well above the level at which it was noted immediately after the birth of the child;

(b) The change in the shape of the uterus from a somewhat irregularly elongated mass to the more or less ball-like shape which is characteristic of the empty organ;

(c) A gush of blood from the vulvovaginal orifice;

(d) Further protrusion of the umbilical cord;

(e) A loss of the expansile impulse in the cord when pressure is exerted on the fundus of the uterus.

Although one may wait a number of hours for natural expulsion to take place, such expectancy is quite unnecessary and most

Fig. 2. Separated but incarcerated placenta in an hour-glass uterus. Note the thick ridge of muscle tissue beneath the placental site. This must be artificially dilated before the imprisoned placenta can be removed.

inconvenient since the attendant must preserve an aseptic technique until the placenta is delivered. On the other hand, to leave the patient while the placenta is within the birth canal is to risk the danger of a fatal hemorrhage.

A separated but incarcerated placenta (Fig. 2) is very rarely encountered in ordinary obstetric practice. Following an obstructed labor, the placenta may be held within the upper segment by a definite retraction ridge which forms at the isthmus of the uterus. This rigid ring results from a spasmodic contraction and thickening of the uterine musculature and cannot be dilated without the use of deep anesthesia. While it occurs most commonly in obstructed labors, it may also follow early rupture of the membranes in certain cases in which the uterus becomes molded about the child's body. Oxytocic drugs, when administered injudiciously, likewise may aid in the production of this complication. Formerly, when ergot was given before the birth of the placenta, hour-glass contraction of the uterus was observed rather frequently. Even now it occasionally follows the use of pituitary extract when this

drug is employed as a means of hastening the separation and expulsion of the placenta.

Fig. 3. Method of artificially separating and expressing the placenta. With the fingers behind and the thumb in front, the uterus is compressed from side to side, after the manner of pitting a cherry. Pressure is then exerted in the axis of the pelvic inlet. (Beck, Obstetrical Practice, Baltimore, Williams & Wilkins.)

The constricting ring of spastic muscle naturally must be relaxed and dilated before the placenta can be expressed. For this purpose, a hypodermic injection of 5 mm. of adrenalin, 1:1000, may be tried, or the patient may be deeply anesthetized before expression by means of Credé's maneuver is attempted. Usually, however, it is necessary to introduce the coned fingers of one hand, and manually dilate the constricting ring under deep anesthesia. Successful relaxation has been reported following the use of a spinal anesthetic.

Adherent but separable placenta may be due to a defective decidua in which the customary fragile network of the spongy layer is abnormally dense. Cleavage also may be retarded by an unusually extensive placental attachment. This complication accordingly is encountered more frequently in twin and succenturiate placenta and is a common accompaniment of placenta membranacea. The various congenital anomalies of the uterus and multiple myomata lead to alterations in the contour of the uterine cavity, and are predisposing causes of inertia. They therefore are occasional etiological factors in adherent but separable placenta. The commonest cause of this condition, however, is a lack of the normal contraction and retraction of the uterus in the third stage of labor. This impairment of function often is the result of overdistention of the uterus, prolonged labor, or the use of sedative drugs and anesthetics. It likewise may be due to a distended bladder since catheterization frequently is followed by rapid separation and expulsion of the placenta.

Unfortunately, an adherent but separable placenta often becomes partially detached and, as a result, may give rise to bleeding of alarming proportions. If little or no blood is lost, an expectant attitude for at least one hour after the birth of the fetus is advisable. At the expiration of this time, active interference is indicated. On the other hand, immediate intervention is recommended whenever the hemorrhage is profuse. By means of external manipulations, the placenta must then be artificially separated and expressed or it must be removed manually from the uterine cavity.

The external method of artificially separating and expressing the placenta consists of fundal compression through the abdominal wall. With the fingers behind and the thumb in front, the uterus is squeezed successively from side to side after the manner of pitting a cherry (Fig. 3). Pressure is then exerted in the axis of the pelvic inlet. This procedure differs from that recommended in Figure 2 in that it aims to separate as well as to expel the placenta. If the bleeding is not too severe, manipulations are repeated until the desired result is obtained. At times, however, the hemor-

rhage may be excessive and necessitate immediate manual removal.

The great risk of infection which accompanies manual removal of the placenta makes the use of a strict aseptic technique imperative whenever this operation is done. Since the gown and sterile gloves, which were worn during the delivery, might have become contaminated, they are to be replaced by clean ones, the sterility of which is unquestioned. The vulva, likewise, should again be cleansed with 1:500 chlorothymol solution or painted with half strength tincture of iodine after the patient has been anesthetized. With the thumb and forefinger of the left hand, the labia are then widely separated, and the coned fingers of the right hand, lubricated with 1:500 chlorothymol solution, are passed upward through the vagina and into the uterus (Fig. 4). At the same time, counterpressure on the fundus is made with the external hand. By following the cord, the placenta is easily located and its margin readily found. Search is then made for a plane of cleavage, and, by a side-to-side motion of the fingers, the separation is completed (Fig. 5). The detachment should be complete before any of the placenta is removed; otherwise, part of it may be retained. Following complete separation, the uterus is massaged with the external hand and made to expel both the placenta and the internal hand. The placenta should never be removed while the uterus is in a state of relaxation.

After its removal, the placenta is examined carefully in order that the operator may be certain that no part has been left behind. In case of doubt, the uterine cavity

Fig. 4. Manual removal of the placenta 1. The coned fingers of the internal hand are introduced into the uterine cavity while counterpressure on the fundus is made with the external hand. (Beck, Obstetrical Practice, Baltimore, Williams & Wilkins.)

Fig. 5. Manual removal of the placenta 2. After locating the plane of cleavage, the separation of the placenta is completed by a to-and-fro movement of the fingers. (Beck, Obstetrical Practice, Baltimore, Williams & Wilkins.)

should be explored again, and any retained fragments removed manually. In this connection, the operator will avoid unnecessary manipulations if he will have in mind the irregular and jagged contour of the placental site.

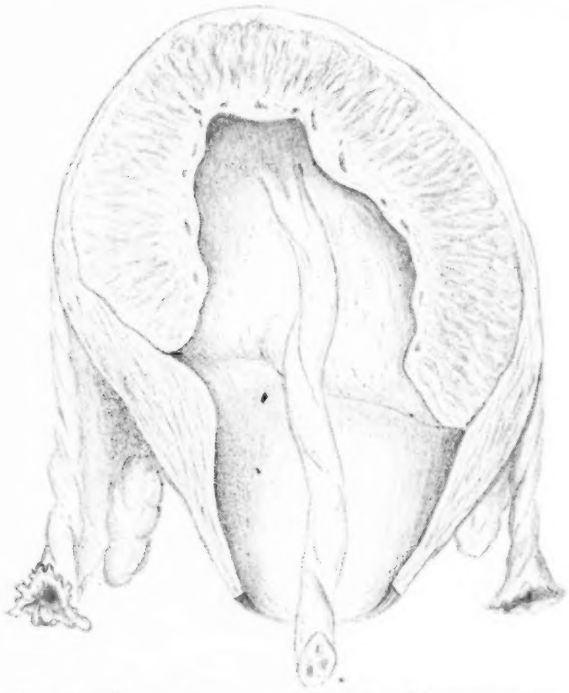

Fig. 6. Placenta Accreta. Note the thinness of the uterus in the region of the placental site. In places, less than 2 mm. of muscular tissue intervene between the placenta and the peritoneum.

Since the external method of separating the placenta may fail to detach it completely and, as a result, may cause such a serious hemorrhage that manual removal may be necessary, the usual aseptic preparation for manual removal always should precede any external attempt to separate the placenta artificially.

Whenever the amount of blood lost is in the neighborhood of 1000 c.c., or causes the patient to show signs of hemorrhage, an immediate transfusion is indicated. This measure is particularly valuable as a prophylaxis against the infection which may follow the operation of manual removal.

Adherent and inseparable placenta, placenta accreta, is very rarely encountered even in active obstetric clinics. It results from an almost complete absence of the decidua basalis, as a consequence of which the eroding chorionic elements penetrate the uterine musculature and firmly fix the placenta to the wall of the uterus (Fig. 6). In one of our cases, the erosive action of these trophoblastic elements was so marked that the villi penetrated the uterine wall almost to its peritoneal covering, and instances have been reported in which complete perforation into the peritoneal cavity has occurred. This complication is thought to be favored by cauterization of the endometrium with caustics, repeated curettings, and the atrophy that is so often observed in the endometrium which overlies a submucous fibroid.

Bleeding from the placental site does not occur when the placenta is adherent and inseparable; likewise, all evidences of detachment are absent. Therefore, whenever the placenta is retained for more than one hour without vaginal bleeding and with a complete absence of the usual signs of separation, placenta accreta should be suspected. If the Credé procedure is attempted, there is always a possibility of rupturing the uterus in the region of the thinned out placental site. For this reason, external manipulations should be most gentle, or, better still, entirely abandoned. Under strict aseptic precautions, the hand is introduced into the uterine cavity and a search is made for a line of separation. When such a cleavage zone cannot be found, the diagnosis of placenta accreta rather than adherent but separable placenta is made, and immediate hysterectomy is indicated. It is the height of folly to attempt to remove piecemeal such a placenta. When this injudicious procedure is tried, serious hemorrhage, shock, perforation of the uterus, or sepsis almost invariably causes the death of the mother.

SUMMARY

As long as the placenta or a part of the placenta remains within the birth passages, strict aseptic precautions must be maintained.

The medical attendant, likewise, never should leave his patient until the placenta is expelled and the danger of postpartum hemorrhage has passed.

Artificial expression of the *retained but separated placenta* is indicated as soon as the signs of separation are detected.

One hour after the birth of the child, a *retained but separable placenta* should be artificially separated and expressed by means of the Credé procedure.

A partially separated placenta, likewise should be completely separated by the Credé maneuver whenever bleeding during the third stage becomes excessive.

If the Credé procedure is unsuccessful in either circumstance, manual removal of the placenta is indicated. Before attempting to separate the placenta by external manipulations, therefore, aseptic preparations for a manual removal always should be made, in order that the latter operation may be done with the minimum risk if the unsuccessful Credé procedure greatly increases the hemorrhage.

Deep anesthesia is required to relax the rigid ring of an hour-glass uterus before a *separated but incarcerated placenta* can be removed.

Adherent but inseparable placenta, placenta accreta, is accompanied by a very high maternal mortality, when the ordinary methods of treatment are employed. These poor results may be improved considerably by a more general use of hysterectomy for this rare complication.

PLACENTA PREVIA*

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PLACENTA previa is not a frequent complication of pregnancy. Statistics from obstetrical clinics indicate an incidence far in excess of the actual frequency. In our own service, in a series of 7981 cases studied by P. H. Smith, placenta previa was encountered 60 times, or 0.75 per cent, or once in 133 cases. The incidence of the Chicago Lying-In Hospital as reported by Davis was 9.02 per 1000. Irving gives the incidence of the Boston Lying-In Hospital as one in 92. In the Cook County Hospital of Chicago the frequency was one in 352. The actual incidence has been estimated at from 1 in 500 to 1 in 1000 and a figure somewhere between these two probably would indicate its frequency as accurately as is possible. The frequency in obstetric clinics is far greater than in the hands of the practioner because women who bleed severely are sent, if possible, to a hospital. It is more frequent in multiparae than in primiparas (64 to 35, Davis; 61 to 39, Marr; 8 to 1, Irving; 41 to 19, Evanston Hospital).

The first evidence of the presence of placenta previa is painless hemorrhage which occurs without relation to any trauma. It is usually in the last two months. It may occur while asleep, the woman awaking to find blood in the bed. The first bleeding may be small in amount and usually is not enough to be dangerous. It is always followed by later bleeding, the subsequent hemorrhages increasing in amount. The progressive development of the lower uterine segment separates an increasing area of the uterine surface from the placenta, thus increasing the area from which blood may be lost. If labor begins, effacement and dilatation of the cervix also increases the area from which bleeding may occur. The occurrence of painless bleeding toward the end of pregnancy in a woman otherwise perfectly well raises at once the presumption of placenta previa. As the primary purpose of this paper is the discussion of the management of placenta previa we will proceed at once to its consideration.

In general, it may be stated definitely that the most important thing in the management of placenta previa is the conservation of blood. Death rarely occurs from the first loss of blood but later bleedings become more and more severe. The first loss of blood may, if necessary, be remedied by transfusion but continued hemorrhage will be fatal. The earlier in the progress of the case the bleeding is brought under control the greater the chance of the mother. The conduct of the case must be such that trauma to the cervix and lower uterine segment is avoided, as tears of the cervix may involve a portion of the placental site and greatly increase the loss of blood. Asepsis is essential as women with placenta previa are often anemic and therefore far less resistant to infection. Upon the admission to the hospital of a patient with placenta previa, even though immediate transfusion may not be needed, donors should be secured, and necessary matching and cross-matching completed, in order that blood may be available immediately at any time.

It is better not to have a hard and fast rule for treatment. Management should be chosen according to the conditions presented by the individual patient. In

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choosing the method of management the mother's interests are paramount, the consideration given the child varying with the length of the pregnancy, the type of placenta previa, the degree of dilatation of the cervix and the amount of blood loss. In a considerable proportion of cases the child is premature. In 16 cases of the 60 studied in our service fetal heart tones were absent on admission to the hospital or disappeared before delivery. It is desirable to save a child at or near term which is alive and apparently in good condition but the mother should never be subjected to additional risk to save a dead or dying infant.

Placenta previa may be divided into central or total placenta previa, or those cases in which the os is entirely covered by placenta, lateral or partial placenta previa, only a part of the os being covered, and marginal placenta previa, the edge of the placenta being felt beside the os. It is important to know which type is present before deciding upon the treatment. Many years ago Jaggard stated the principle that there is no conservative treatment of placenta previa. Further hemorrhage is inevitable, and, as blood is present in the vagina, the risk of infection cannot be ignored. Bacteria are always present in the vagina and cervix and in some women organisms of a virulent character are found. The presence of infection increases the danger of any form of interference. This rule has been modified by some obstetricians to the extent that, provided hemorrhage has not been severe, the woman in good condition, the child alive but of doubtful viability, observation may be continued in the hope that the child may develop sufficiently before intervention so that its chance of life may be greater. If this is done the patient should always be placed in a hospital with everything in readiness for immediate action. The patient and the physician must accept a definite risk for severe hemorrhage may occur suddenly at any time and may be great enough to compromise seriously the chances of a successful outcome. If viability is doubtful, the likelihood of gaining sufficient time to alter materially the fetal prognosis is not great. This plan should be adopted rarely and only after careful consideration.

Methods of Treatment. Prior to determining the mode of attack a careful and gentle vaginal examination should be made, under all aseptic precautions, to determine the type of placenta previa, the degree of dilation and the presentation. All preparations for immediate intervention should have been made before this is done. Although there may be no bleeding at the time the examination is done a profuse hemorrhage may follow. Rectal examination may also cause hemorrhage. Examination should not be done in the home unless the patient is seen in a place in which hospitalization is impossible. Preparation should be made for such interference as is contemplated or which is possible before examination. Early cases of placenta previa usually can be moved. The conditions found at the examination will influence the choice of a method of management. If the initial hemorrhage has been severe, or if a number of bleedings have caused an anemia, transfusion at once will be of great value. The initiation of treatment should not be delayed after transfusion as further blood loss is inevitable. A temporary benefit from transfusion is of little use to the patient if further loss of blood is allowed to take place. In the absence of a donor glucose solution may be used and a solution of gum acacia intravenously may be of great value. While these solutions are of great help in restoring the volume of circulating fluid, particularly the gum acacia solution because it tends to remain in the vascular system longer than glucose solutions, none of them supply the hemoglobin which is imperatively needed and without a sufficient supply of which life cannot continue. Transfusion is the only way in which this vital need may be supplied. It is best, if the woman is seen when only a slight hemorrhage has occurred, to prevent further severe blood loss.

Rupture of the Bag of Waters. In cases of marginal placenta previa and in some cases of lateral placenta previa this simple maneuver controls bleeding. It is used best when a dilatation of 3 or 4 mc. is present. It allows the head to sink into the lower uterine segment, compressing the placenta and thus controlling the bleeding. The rupture of the amniotic sac tends to lessen further separation of the placenta from the uterine wall. No further interference may be needed and labor may complete itself spontaneously. In cases to which it is adapted this simple procedure is very valuable. It can be done quickly and without the need of an anesthetic. The rupture of the membranes usually stimulates contractions which drive the head downward against the placenta and hasten labor. If pains do not begin or are weak pituitrin may be administered in doses of 1 to 3 minims intramuscularly. Care must be taken if pituitrin is used as a too active response may cause the head to be driven too forcibly against the cervix causing a too rapid dilatation. This may result in laceration with severe bleeding.

Packing. This is the least efficient method for the control of hemorrhage, and, in addition, it carries with it a distinct risk of infection, especially if any other method of treatment follows it. It cannot be recommended as a method for use in the hospital and in our own service we have never used it. A pack rarely completely controls bleeding. It is assumed that a pack placed firmly against the cervix will compress the placenta against the head but one cannot depend upon this even though a tight binder is used. Blood may collect in the lower part of the uterus above the pack. In a locality in which hospitalization is quite impossible, and anesthesia and sufficient help for the application of some one of the other methods of treatment are also not available, a pack may be employed in default of something better.

Infection may follow the use of a pack. When applied at home it will rarely be properly inserted. To pack at all efficiently, the cervix should be exposed. The pack should fill the cervix and lower uterine segment tightly as well as the vagina. The gauze should contain some weak antiseptic to prevent, as far as possible, the development of infection from bacteria in the vagina and cervix. Gauze impregnated with a ½ per cent solution of cresol serves very well. If the pack is successful in controlling the bleeding it may be left until dilatation is complete, after which it is removed and delivery completed by version and extraction. The defects of this form of treatment are (1) the uncertainty of control of hemorrhage, (2) the difficulty of knowing exactly when dilatation is complete, and (3) the likelihood of infection.

Metreurysis. In many cases the insertion of a bag is a very satisfactory method. It is particularly useful in a multipara with a marginal or lateral placenta previa and with a dilatation of 3 or 4 cm. although a smaller dilatation does not preclude its use. The membranes should be ruptured and the bag placed intraovularly. Intraovular insertion is far more efficient than insertion outside the membranes. A weight of one pound is attached by a tape to the bag, the tape passing over a pulley at the foot of the bed. A bag of proper size and properly placed will control bleeding as long as it remains within the cervix. A woman upon whom metreurysis has been performed must be kept under constant observation as the bag must be removed from the birth canal as soon as it escapes from the cervix. This can be readily ascertained by gentle rectal examination. If the bag escapes from the cervix and remains in the birth canal blood may accumulate above it, a considerable quantity being retained. Recurrence of bleeding demands immediate further intervention. Complete dilatation following metreurysis may be followed by spontaneous delivery which is the most favorable outcome for the child and spares the mother further intervention.

Metreurysis is ranked among the conservative forms of therapy. It gives excel-

lent results for the mother if the bag is put in early before serious blood loss has taken place and provided that the mother is watched constantly, to forestall further blood loss after the expulsion of the bag from the cervix. Spontaneous delivery is most favorable both for mother and child but in some instances cannot be awaited. After the expulsion of the bag, if dilatation is not complete Braxton Hicks or podalic version may be needed to keep bleeding under control. No attempt to complete the delivery should be made until dilatation is complete. If version is required it must not be followed by an attempt to complete delivery until dilatation is complete. It is best to allow the breech to be expelled by the forces of labor and to intervene to complete the labor only after this has happened. As the placenta occupies the lower uterine segment and cervix, these structures contain the large blood sinuses which always lie under the placenta. An attempt to complete delivery before dilatation is complete is likely to cause lacerations of the cervix and lower uterine segment with consequent severe bleeding. If after the removal of the bag, the head settles into the lower uterine segment and cervix and controls bleeding, labor must be permitted to continue until dilation is complete. The bag itself, as Irving points out, is relatively without danger. It is the method of delivery which influences maternal and fetal mortality.

Braxton Hicks version was suggested first by Hicks in 1864. A dilatation sufficient to permit the introduction of two fingers is essential. In many cases it will be a difficult procedure, especially for the physician whose experience in operative obstetrics is limited. One foot is grasped and brought down through the cervix, the buttocks and the other thigh of the child tamponing the lower uterine segment and compressing the placenta. It is an exceedingly effective method of controlling bleeding. It is essential that no attempt at delivery be made after the version. Nothing more should be done except, if necessary, to apply some traction to the leg in order to compress the placenta more effectively. Fetal mortality is high. Maternal results are excellent provided delivery is not attempted until dilatation is complete.

Podalic Version. Podalic version may be used in patients with marginal or lateral placenta previa who are admitted to the hospital with sufficient dilatation to permit the entrance of the whole hand into the uterus, or when metreurysis has been done and sufficient dilatation has been secured to allow the operation to be done. The inexperienced operator may be greatly tempted to complete the delivery after version is completed. Unless dilatation is complete at the time the version is done extraction should not be attempted. This should await the completion of dilatation and the spontaneous extrusion of the breech.

Cesarean Section. Tait in 1869 suggested cesarean section, and abdominal delivery was also recommended by Dudley in 1900. The use of cesarean section has greatly increased in this country. It is true that a larger number of infants may be born alive when cesarean section is used widely but this must not obscure the fact that many of these babies are premature. Cesarean section, to yield reasonable results for the mother, must be done while the patient is still surgically clean. Abdominal delivery after packing, the introduction of a bag or repeated examination, is not safe. Many cases of placenta previa occur in communities in which no trained obstetrician is available and the local surgeon is asked to lend his aid. As he is usually quite unfamiliar with operative obstetrics but feels able to perform a laparotomy, cesarean section is usually chosen. A lack of information as to the relative risks of the cesarean section, done as an elective procedure and when it is performed after more or less extensive interference from below, plays a large part in the continuance of the far too large maternal mortality after cesarean section. To obtain satisfactory results it should be done as a primary procedure, not following some form of interference from below.

For many years the classical operation was done exclusively. In late years the low cervical section has displaced it in some clinics. In our own service for some time after adopting the low cervical operation as the routine procedure we continued to do classical sections when a cesarean was chosen as the treatment of placenta previa. This was because we feared that an incision in the lower uterine segment might cause further serious bleeding by reason of invasion of the placental site. Experience has shown that this is not the case and the low cervical operation is used at present in nearly all cases in which abdominal delivery is used. It may seem illogical that an incision made from above does not increase the risk, while dilatation or cutting operations, such as vaginal hysterotomy, are gravely dangerous. The chief reason for this difference is that, while incision from below or lacerations following attempts at dilatation of the cervix may extend upward far enough to preclude effective management from below, the incision in the lower uterine segment made through the laparotomy wound is throughout its extent under the eye and bleeding from its edges may be effectively checked. Bleeding sinuses on the posterior wall may be closed by suture. Extension into inaccessible areas does not occur.

Cesarean section should be chosen in total or central placenta previa and in patients with lateral or marginal previa in which there is little or no dilatation. In the minority of cases in which it occurs in primipara it offers the quickest and often the least traumatic method of delivery. Unless the hazards of delivery from below seem great it is preferred if the baby is dead or non-viable.

If bleeding continues after the delivery of the child and the removal of the placenta, the uterus can be packed, the end of the pack being passed through the cervix into the vagina. It may be removed from eight to twenty-four hours later.

If infection is present, a cesarean section should be followed by amputation of the uterus. This greatly decreases the danger of sepsis after operation. This procedure should be chosen if the mother is infected or if it is seriously feared that infection is present. The prognosis is much better than when an infected or potentially infected uterus remains. When infection is feared, delivery from below is usually wiser but, in case the preservation of the child is desired greatly, and the condition of the child is such that it appears probable that it may be delivered alive and with a fair prospect of continued life, the Porro cesarean may be done.

Vaginal Cesarean Section or Vaginal Hysterotomy. This procedure cannot be recommended. For a time it received the recommendation of some German writers but has not been accepted widely in this country. In view of the conditions found in placenta previa it does not seem a logical method of attack. The incision invades the subplacental area and the operator can never be quite certain that an upward extension of the incision may not occur. This may cause the cervical wound to reach an inaccessible area. We have never used this method of treatment and believe that it is a dangerous procedure.

Willett's Forceps. This mode of management is carried out by grasping the scalp, in a cephalic presentation, with an instrument resembling a volsellum, and making traction downward in order to cause the head to compress the placenta. It should be confined to dead infants although a few cases have been reported of the birth of living infants. We have had no experience with it as it has not appeared to us to be an efficient procedure.

Accouchement Forcé and Manual Dilatation. Accouchement forcé is left to the last and should be mentioned only to be condemned. In view of the condition from which the bleeding comes it is apparent that it is a completely illogical method of treatment. In our service it has not been used. It belongs to the dark ages of obstetrics and should be regarded as a procedure which has no place in modern practice.

Manual dilatation is open to the same criticism. Manual dilatation usually means completion of dilatation after the cervix has already reached a diameter of 5 or 6 cm. Manual dilatation varies only in degree from the more traumatic accouchement. Any attempt to complete dilatation by operative intervention is an invitation to disaster. After delivery of the child, the placenta should be removed manually unless it is expelled promptly. This should be done gently in order to avoid any wounding of the placental site.

After delivery is completed, if this is accomplished through the birth canal, and if bleeding continues, the uterus should be packed. In any case in which doubt exists as to the ability of the uterus to control postpartum bleeding, packing should be used. In these cases, as in others, it must be remembered that an efficient pack extends from the fundus of the uterus to the vulva. A pack which occupies the lower part of the uterus only, or leaves a part of the uterine cavity unoccupied, may allow blood to accumulate above it.

CONCLUSIONS

The successful management of placenta previa depends, (1) upon its early recognition; (2) upon a prompt and proper choice of procedure, remembering that the saving of blood is the thing of outstanding importance, and (3) painstaking asepsis. In well managed obstetric clinics the maternal mortality may be kept to 5 per cent. A considerable fetal mortality cannot be avoided. While this should be kept as low as possible, the safety of the mother should not be jeopardized in favor of a premature infant whose chance of survival at best is questionable.

MANAGEMENT OF ABRUPTIO PLACENTAE

REVIEW OF 65 CASES

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ABRUPTIO or ablatio placentae is the partial or complete detachment of the placenta from its normal site in the uterus; its separation is premature because it occurs prior to the third stage of labor. Hemorrhage is accidental, in contrast with the unavoidable bleeding of placenta previa. Differential diagnosis must be made from premature labor, rupture of the uterus and placenta previa; though easy as a rule, it must be borne in mind that in cases of low implantation of the placenta, separation may occur with the onset of labor, as in marginal previa, so that differentiation may be difficult or impossible.

Abruptio is not unusual, and occurs more frequently than placenta previa, if we include all those cases of loosening of the lower pole of a low placenta, in which slight bleeding is noted before the onset of labor and constant trickling occurs throughout; after delivery well formed clots are found attached to the placenta. More complete detachment is uncommon, certainly less frequent than placenta previa. Its frequency is of scant importance however. It is important to remember that it may occur in any primipara or multipara of any age.

Since there is a general trend to interfere surgically in the serious complications of obstetrics, the whole gamut of vaginal interference has been run; simple puncture of the membranes, cervical and vaginal packs, bags, forcible dilatation or incision of the cervix, version and extraction, forceps and craniotomy have all been recommended. As in placenta previa, there is a steadily increasing tendency to treat severe cases by abdominal section. Some are unalterably opposed to any other form of treatment, while others, with equally large experience, find cesarean section disappointing. In fact the advice of those who have studied this problem is often puzzling and contradictory.

Interest in this serious complication of pregnancy and labor is growing, though contributions to the literature are still relatively infrequent, and more concerned with investigation into its causes than with its practical management. Perhaps this is as it should be, for only through knowledge of its etiology can a positive program be evolved. In the meantime however, clinical factors must be studied, and abruptio placentae treated on the basis of collective experience. It is no different in eclampsia, where, though we are still ignorant of its etiology, definite reduction of mortality has followed critical appraisal of end results. Up to now treatment has largely been based upon individual experience, necessarily limited and influenced by trends toward conservatism or operative interference in the general field of obstetrics. We agree on the management of the less severe cases which we are confident will end in spontaneous delivery. Nothing more is settled. Judged by results, making all due allowances for its intrinsic difficulties, the problem of abruptio placentae is still unsolved.

With increasing interest in our own maternal mortality we have reviewed our experience in 19,750 deliveries at St. Catherine's Hospital, Brooklyn, from January 1917 to October 1936. There were 65 cases of abruptio placentae, an incidence of 1 in 300. Eight cases filed as abruptio placentae were rejected as separa-

tion of a low placenta. Only those cases in which diagnosis was absolutely certain are included. Brief tabulation follows:

ABRUPTIO PLACENTAE 65 CASES

Multiparae 40. Primiparae 25	
Period of Gestation	
Term	29
Eighth month	11
Seventh month	25
Presentation	
Vertex	49*
Breech	15
Face	1
Transverse	1
Etiology or Associated Condition	
Preeclampsia	2
Low reserve kidney	9
Chronic nephritis	18
Trauma (coitus 2, fall 1)	3
Unknown	33
Method of Delivery	
Spontaneous delivery	24*
Bags	9
Manual dilatation	2
Incision of cervix	1
Version and extraction	4
Breech extraction	8
Forceps	4
Cesarean (1 vaginal)	14
Mortality	
Fetal	46 or 70 per cent
Maternal	5 or 7.7 per cent

* One case twins.

ETIOLOGY

Although its etiology is unknown, the cause will probably be found in trauma, vascular changes in the uteroplacental junction or toxemia, yet all these have been denied. Although presence of a specific toxin has been assumed as in eclampsia, none has been found. Both conditions may occur with equal suddenness, in both operative procedures find equally bad risks, and both, strictly speaking, are not preventable. Possibly trauma may be insufficient unless some other factor is present. Chronic nephritis, so commonly observed in many series of cases, is of no importance in others. In our series there were 18 well marked cases of chronic nephritis, 3 of which developed anuria and one convulsions, 9 women with low reserve kidney and 2 with preeclampsia. Two women, both nephritics, had abruptio in two successive pregnancies. Furthermore, 3 women in this series with no signs of kidney involvement showed definite nephritis in subsequent pregnancies within two years. This would seem to indicate the incidence of a kidney coefficient in at least 21 cases, or 34 per cent, without including 9 cases of low reserve kidney. Whether it is an actual causative factor or simply an associated disease makes no difference clinically. The occurrence of vaginal bleeding in the last trimester, with or without pain, in a woman known to have nephritis or hypertension is of great significance in the diagnosis of abruptio placentae. Accidents during version, sudden collapse of a polyhydramnion or drag on a short cord, often mentioned by others, were not seen in our series. The history of trauma in 3 cases was clear enough.

SYMPTOMS AND DIAGNOSIS

Frank bleeding was present in 60 cases, 35 of which had bright red profuse hemorrhage; bleeding was concealed in only 5 cases. There were 26 severe cases, including 19 patients in profound shock and 7 others with severe toxic symptoms. In 49 patients pain was a prominent symptom.

Bleeding may or may not be severe when the lower pole of the placenta separates; hemorrhage is frank, blood rapidly detaching the membranes and escaping from the cervix. The placenta may separate centrally, or at its periphery laterally or near the upper pole, blood stripping the membranes and occasionally bursting into the amniotic sac. In uteroplacental apoplexy or the Couvelaire uterus, blood makes its way widely into the muscle of the uterus appearing as ecchymases beneath the serosa, which may split, allowing blood to seep into the peritoneal cavity. It is clear that in all cases blood is concealed at first, if only for a short time, and so must give rise to symptoms before it appears.

During pregnancy slight bleedings may occur. Although these are always worthy of note, and in the absence of pain should be regarded as evidence of placenta previa and not separation, the placenta may show signs of old detachment or organized clot. In serious cases the onset of symptoms is always sudden, and always accompanied

by pain which may be severe. Labor usually comes on shortly, and may fortunately be active; or if uterine contractions are weak a serious situation may develop very rapidly with signs of severe hemorrhage and shock, in pallor, pulse, blood pressure, respirations, restlessness, nausea, vomiting, and even convulsions and coma. The fetal heart is lost,—classically after tumultuous fetal movements, although we have not observed this phenomenon. The fetal heart was lost before delivery in 30 of our patients; this is not a fair criterion of the severity of any case. Uterine resiliency grows less, or the uterus becomes tense and hard, tender over the area of hemorrhage; in some cases the uterus seems to increase in size, arching forward as a result of increased muscle tension as if it were in tetanic contraction. The classical ligneous uterus, observed by us in only 28 cases, is not necessary for diagnosis; the uterus may even be soft. Watching for this sign is like waiting for external bleeding, unnecessary and dangerous. Pain, nausea, rising pulse rate or even slight faintness are more often available.

MORTALITY

Five women, or 7.7 per cent, in our series died. Brief description of their deaths is instructive:

Case I. Aged twenty-eight years, para VIII, vertex at term, was admitted in 1924 in severe shock, pain, a ligneous uterus, and history of profuse vaginal bleeding four hours before. She had repeated clyses and version; a leg was drawn through the cervix, and she delivered herself spontaneously of a stillborn fetus in a half hour; the placenta which followed immediately was small with numerous white infarcts; the vagina was packed for hemorrhage. Death two hours later was from shock.

Case II. Aged forty-five years, para IX, vertex, was admitted in 1930, two hours after a severe hemorrhage which occurred immediately after a fall downstairs; in profound shock, no fetal heart heard and a ligneous uterus. She died undelivered two hours after insertion of a Voorhees bag. Necropsy showed a seven and one-half months pregnant uterus of normal appearance, which contained a dead fetus and a completely detached placenta covered with heavy clots.

Case III. Aged forty-two years, para XI, breech, was admitted in 1933 in shock, no fetal heart and a ligneous uterus, with a history of pain and profuse vaginal bleeding. She had had nine normal spontaneous deliveries, the tenth terminating in a seven months stillbirth due to abruptio placentae and chronic nephritis. The membranes were ruptured, a leg pulled down and three doses of pituitrin given at fifteen minute intervals. Delivery of a stillborn fetus occurred within an hour and a half. The placenta, covered with clots, followed immediately. Bleeding continued and the uterus and vagina were packed. Death followed two hours later without transfusion as no donor could be obtained.

Case IV. Aged twenty-five years, para I, vertex, at term, was admitted in 1932 with a history of hypertension for several years. She had been studied frequently and hypertension was said to be essential and not due to nephritis. She presented toxic symptoms, double mitral lesion, blood pressure 240/140, albuminuria, N.P.N. 35 and creatinin 2.4. Shortly after admission she had a profuse hemorrhage, the fetal heart disappeared, and symptoms of severe shock developed rapidly. Morphine and intravenous glucose were given. Cesarean section was preceded and followed by a transfusion. The uterine cavity contained large clots, a completely detached placenta and a dead fetus. The wall of the uterus appeared normal, but hysterectomy was done because bleeding continued. Death occurred three hours later, with poor pulse, weak heart sounds and cyanosis.

Case V. Aged thirty-seven years, para II, breech, seven and one-half months, was admitted in 1935 with toxic symptoms and edema of hands, face and feet for three weeks prior to admission, and slight vaginal bleeding. Blood pressure was 250/150 with heavy albuminuria. The membranes were ruptured and labor began at once. Breech extraction was done after thirty-six hours; the placenta, filled with infarcts, followed at once. The patient became irrational, developed hyperpyrexia and paralysis and died of uremia three days later.

MANAGEMENT

There were 14 cesareans, one of them vaginal, with one maternal death and 9

dead babies; in 13 cases Couvelaire uterus was observed 6 times, but Porro section was not done and no undue postpartum bleeding followed. In one cesarean section, free blood was found in the peritoneal cavity, and a long rent in the posterior wall of the uterus, involving the muscles yet not communicating with the cavity, was closed. The Couvelaire uterus of itself is not an indication for hysterectomy which should be done only for persistent hemorrhage. Uteroplacental apoplexy can not be diagnosed, of course, without opening the abdomen, and accidental hemorrhage does predispose to postpartum bleeding, yet even this type of uterus may contract satisfactorily.

Shock is all out of proportion to the amount of blood loss, worse in cases with toxemia, and aggravated by the trauma of delivery. Transfusion may be wise before and after delivery, and on the delivery table as well. Less constant factors than the need of blood replacement undoubtedly play their part, but its importance at least is obvious. Formulation of a positive program beyond this point is difficult.

We should not look for spontaneous cure. Certain basic principles should guide the design and selection of treatment. Preparations for transfusion should begin at once, whether it may appear to be necessary or not. Treatment should never consist of less than this. Early diagnosis is paramount. Watchful waiting in the form of successive blood counts and nothing more is futile and dangerous. The time factor is important. The greater the delay in emptying the uterus, the greater the likelihood of continuing and postpartum hemorrhage. There is a broad indication for delivery, just as there is in eclampsia, where the method of delivery is no less important; yet as in eclampsia, the condition of the patient is more important, and mortality is often due to treatment.

The fetal mortality is notable, and with it comes the implication that the condition of the child should be disregarded in selecting treatment. However this is no more true in abruptio than it is in placenta previa. Certainly if the baby is alive and viable, and delivery can not be effected speedily from below, abdominal section should be done if the patient's condition is good enough, for that is more important than the presence of a fetal heart.

SUMMARY

Trauma and further blood loss should be minimal in the treatment of shock. Few cases need cesarean section and certainly not those already in severe shock, nor those threatened with the anuria or uremia of chronic nephritis. If cesarean is done, it should be low and preferably under local anesthesia, not spinal or ether. Manual dilatation or incision of the cervix have no place in modern hospital treatment. The use of bags is not sound, since it is time consuming, not certain to induce labor, and increases the risk of infection. Version adds to shock and should not be practiced.

Most cases, even severe ones, properly fortified by transfusion will do best with conservative treatment: morphine grain ¼ to ½, the Beck binder and a few small doses of pituitrin. If labor makes satisfactory progress delivery should be spontaneous, or it may be terminated with low forceps. Manual removal of the placenta should not be delayed long, and the uterus must be packed if it does not contract satisfactorily with intravenous pituitrin and ergotrate.

Few cases call for more radical interference. All need close supervision and good judgment. There is a certain unavoidable mortality, no matter how abruptio is managed, yet a fatalistic attitude which can defend and justify any course of treatment, simply because mortality is high will not help the situation. Usually it is possible to differentiate between the cases, those that need cesarean section, and those that can be managed conservatively by allowing them to progress to assisted spontaneous delivery.

All my statistics, as well as these abstracts of the case histories of the deaths were prepared by Dr. Leslie H. Tisdall.

CESAREAN SECTION: INDICATIONS AND TECHNIQUE

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CESAREAN section has occupied a prominent place in the obstetric literature for the past decade. Large series of cases, carefully analyzed, have been published from several clinics. The technique of the operation has become well standardized and offers no difficulty to the trained surgeon. The results of this method of delivery have been improved considerably by the more general adoption of the low or cervical operation which has slowly but gradually replaced the classic cesarean section in the hands of a large number of obstetricians. Improvements in technique are not likely to come in the near future and progress must follow from realizing that cesarean section is not a panacea for all obstetric ills. While large numbers of recently published cases show no maternal mortality, or a low one, the statistics taken by and large demonstrate definitely that maternal mortality and morbidity after abdominal delivery are higher than after any form of pelvic delivery, possibly with the exception of destructive operations performed on women who have been long in labor and on infected women. The low or cervical cesarean section carries a lower mortality rate, even when performed on patients who have had an adequate test of labor, than does the classic operation performed at the time of election, without labor, and on women who are considered in excellent condition. One important factor in favor of the low operation is that intestinal adhesions and obstruction are found rarely following this method of delivery, while adhesions of the intestine to the uterine scar, after the Sänger operation, are not uncommon. It has been proved that the scar of the low or cervical operation is a much stronger one than that placed in the uterine corpus. In my series of cases there were 164 repeated low cesarean sections; 159 incisions were firmly healed and 5 scars proved to be defective. Of these, 3 scars were thin; the fourth, a longitudinal scar, had extended into the uterine musculature because of a voluminous fetus; the repeat operation was done after eleven hours of hard labor, it was found that the portion of the scar which was in the lower segment was firmly healed, but that the area which had been extended in the musculature was held only by the peritoneum. In a fifth patient, the lower segment was healed, but it was thin at its middle point, this observation being made while performing the sixth cervical cesarean section.

The indications for cesarean section have doubtless been extended during the last twenty years, perhaps in part because of the improved results of the low operation. While the mortality has decreased in the hands of those who are expert in doing this type of operation and in selecting patients for the operation, the mortality still remains high in the hands of those who are less experienced. The tendency of the times is to limit, rather than to increase the indications. The type of operation to be selected is of prime importance, thus, a woman who has been in labor for a long period of time, who shows exhaustion, thermic elevation and signs of infection, might be saved if delivered by the Latzko extraperitoneal operation or by the Porro operation, while she might succumb from peritonitis if the Sänger operation were employed.

INDICATIONS

The indication for cesarean section may be absolute or relative: absolute when it is impossible for a child to be born alive

through a given pelvis, and relative when the child might be born through the pelvis but when the chances of survival for mother and child are increased when the abdominal route is chosen. The indications for cesarean section may be given under several headings.

Contracted and Deformed Pelves. When the contraction and deformity are extensive there is no other method of delivery except by a destructive operation and cesarean section should be elected in the interest of mother and child. Extensive deformities should be recognized during pregnancy, so that the operation may be performed at the optimum time. The operation may be considered in the interest of the child when it is obvious that it cannot be delivered with safety through the birth canal. Except under rare conditions, such as hemorrhage from placenta previa and in the presence of premature separation of the placenta, with a hard unyielding cervix, it should not be performed when the fetus is dead.

Dystocia from Abnormal Position of the Infant and from Previous Surgical Operations. Cesarean section is seldom necessary because of abnormal positions of the infant if the pelvis is adequate, as the fetal position may be corrected by the usual obstetric means. If, however, the abnormal position of the fetus is complicated by some degree of pelvic contraction and deformity, it may have to be chosen for the welfare of the infant, and frequently of the mother.

At the present time resort to surgical operations for the correction of lacerations and of uterine prolapse are frequent during the childbearing age. A repair of the cervix by trachelorrhaphy and a round ligament suspension of the uterus, as a rule, do not complicate future labors. On the other hand, a high amputation of the cervix and an abdominal fixation of the uterus may cause such severe dystocia that cesarean section becomes imperative. The previous repair of extensive vesicovaginal fistulas, and of complete lacerations of the perineum, especially those extending for some distance in the rectum, may become indications for abdominal hysterotomy.

Placenta Previa. Severe hemorrhage from placenta previa, regardless of the variety, may necessitate cesarean section in the interest of mother and child, but, in deciding this point, the amount of bleeding and the condition of the cervix are more important than the variety of placenta previa.

Ablatio Placentae. With a hard, rigid, undilated cervix, abdominal hysterotomy may be necessary in the interest of the mother, when there is complete separation and, in the interest of the infant, when the placental separation is not complete, providing that other conditions are favorable for the successful outcome of the operation.

Pelvic Tumors. Fibroids and ovarian cysts, filling the pelvis ahead of the presenting part are met rarely, but when they occur, form a definite barrier to the progress of labor. Women so afflicted are more favorably delivered by abdominal section followed by the removal of the neoplasm.

Myomectomy. Resort to extensive myomectomy is usual in childless women and those advanced in years. In the first instance it is chosen rather than hysterectomy, so that the patients may have children. When several incisions have been made in the uterus, the danger of rupture of this organ during labor is increased. In the second instance, because of advanced age, the cervix is frequently rigid, making the labor long and tedious with the possibility of a difficult instrumental delivery. Since a woman who has had a multiple myomectomy is usually not very fertile, cesarean section may have to be performed in order to give her the one living child, and should be performed at the time of election.

Eclampsia. In the early part of this century eclampsia was frequently considered an indication for abdominal section, but statistics have shown that it is contraindicated in the presence of this condition, since treatment by conservative means has improved the results markedly. There may be instances when it must be considered,

but these are extremely rare. Occasionally, for toxemia of pregnancy, when conservative treatment has failed, cesarean section may be performed, preferably under local anesthesia, in order to deliver the patient before the onset of convulsions.

Habitual Death of the Fetus. This type of delivery may be justified in the last month of pregnancy, when it is determined that the infant is well developed and alive.

Previous Cesarean Section. If done for an absolute indication, it is a definite reason for an abdominal delivery, but such may not be the case if it has been done for a relative indication, such as hemorrhage, tumor previa, etc. The dictum, "Once a cesarean always a cesarean section," originated in the days of the Sänger operation. While it is true that women have been delivered successfully through the pelvis consecutive to a classic cesarean section, it is equally true that the percentage of uterine rupture is high. Pelvic delivery after the low or cervical cesarean section, however, is a rather safe procedure since the scar in the lower segment heals better and is firmer than that in the uterine corpus. In the 584 cases of cervical cesarean sections which I have reported,[6,9] 17 women were subsequently delivered through the birth canal; 2 parturients were delivered three times, 3 parturients twice and 12 parturients once. The deliveries consisted of normal deliveries, forceps extractions and versions and extractions. All mothers recovered without complications and no deleterious results were observed.

Medical complications such as heart disease, pulmonary tuberculosis or severe nervous disorders may occasionally justify a cesarean section, but, in each instance the opinion of a medical consultant should be sought and a decision reached only after careful consideration of all the factors at hand.

Postmortem Cesarean Section. In advanced pregnancy this should be performed immediately when the mother dies and when the fetus is still alive in utero. By having recourse to this procedure, I have been able to save 3 children, who are grown up and well to-day.

Preparation of Patient. If the patient is to have an elective cesarean section she is admitted to the hospital the day before operation. The evening before operation the lower bowel is evacuated by means of a soap-suds enema, which procedure is omitted if she enters the hospital in active labor, and if the bowels have functioned within twenty-four hours. No active catharsis is used before operation. The abdomen and vulva are shaved and scrubbed with a solution of green soap, the abdomen is gone over with 70 per cent alcohol and a sterile dressing is applied over the entire abdomen and held by means of a properly fitting binder. No douches are given and no antiseptics are used in the vagina. At the time of operation the abdomen is prepared with ether and 3½ per cent tincture of iodine. If the operation is an elective one, the evening before, the patient is given sodium amytal, gr. 3 (0.090 gm.) so that she may secure a good night's sleep and preoperative medication is eliminated, so that asphyxia in the newborn may be prevented.

Anesthesia. I have performed the low cesarean section under nearly all forms of anesthesia. Spinal anesthesia is considered the most dangerous form of anesthesia for a pregnant woman at term, and is not recommended. Ether causes relaxation of the uterine muscle, and in my experience, causes more bleeding than any other type of anesthesia. For the woman in good physical condition, one who has no renal or hepatic complications, avertin, (tribromethanol) 0.070 gms. per kilo, one-half hour before operation, followed by gas and oxygen during the intervention is very satisfactory, and the dangerous effects of this drug are avoided when such a small dose is used. In other words, avertin is used merely as a basal anesthesia and has to be supplemented by gas and oxygen. The infant cries spontaneously, the uterus contracts firmly and bleeding is minimized by this form of anesthesia. Patients who

have nephritic, hepatic or cardiac complications are operated upon under local anesthesia, using one per cent novocaine solution to which one minim, (.060 c.c.) of adrenalin chloride, 1:1000 per ounce, (30 c.c.) is added. Nitrous oxide and oxygen are administered during the two or three minutes required for the delivery of the child. After the extraction of the baby, morphine sulphate, gr. 1/6, (.010 gm.) and hyoscine hydrobromide, gr. 1/130, (0.0005 gm.) are administered subcutaneously. This quiets the parturient during the suture of the uterus and abdominal wall.

CHOICE OF OPERATION

When a cesarean section has been decided upon, the surgeon has the choice of eight types of operation, (1) vaginal cesarean section; (2) the Sänger classical cesarean section; (3) the low or cervical cesarean section with a longitudinal incision, (Krönig-Beck-DeLee); (4) the transverse cervical cesarean section; (5) the Veit-Fromme-Hirst transperitoneal cesarean section, popularly known as peritoneal exclusion; (6) the Latzko extraperitoneal operation; (7) the Gottschalk-Portes operation, or exteriorization of the uterus, and (8) the Porro operation, or cesarean section followed by supravaginal hysterectomy, usually with the conservation of the adnexa.

Vaginal cesarean section is reserved for patients who need a rapid evacuation of the uterus, when the pregnancy is not too far advanced. It can be easily performed up to seven and one-half months of pregnancy, but near term, because of the large fetus, this method of delivery is so much more difficult that it is advisable to choose the abdominal route. During the last twenty years vaginal cesarean section seems to have decreased in popularity, but it is still a valuable procedure when performed under proper conditions which are: (1) the tissues must not be edematous or friable; (2) the uterus must be movable so that the cervix may be readily brought down in the vagina; (3) the pelvis must be ample and (4) the child must not be too large. Regardless of the indication, in the absence of these requisites, the vaginal cesarean section should not be considered.

Classic Cesarean Section; Sänger Operation. This is the original conservative cesarean section which still has many adherents although, as previously stated, it is being replaced gradually by the lower segment operations. A number of obstetricians favor it for placenta previa, but I personally prefer the low or cervical operation when operating for this disorder. The disadvantages of the classic operation are lack of protection against peritonitis, dense adhesions to the scar and a high incidence of weak scars and uterine ruptures. The main advantage rests in the fact that it is the simplest to perform.

Low or Cervical Cesarean Section, with a Longitudinal Incision in the Lower Segment; Krönig-Beck-DeLee (Figs. 1 and 2). DeLee gives the name of laparotrachelotomy to this operation. In its performance the abdomen is opened by a median suprapubic incision, the bladder is separated from the lower uterine segment, an upper flap of peritoneum may or may not be raised, the lower uterine segment is opened by a longitudinal incision and the fetus is delivered, by raising the head with one hand and pressing on the uterine fundus with the other, when the vertex presents, or by applying forceps to the head, and by breech extraction when the breech presents. The placenta and membranes are expressed through the incision which is closed by means of interrupted or continuous chromic catgut sutures. The bladder peritoneum is then sutured to the uterus with a continuous stitch of fine chromic catgut, thus sealing the uterine incision and making it subvesical or retroperitoneal. Isolating the uterine incision from the peritoneal cavity results in definite protection from leakage which not infrequently results in peritonitis. Time has proved that an incision placed in the lower segment heals much more satisfactorily than one placed in the uterine body, and that a firmer scar results. This

operation may be performed safely on a woman who has had an adequate test of labor even though the membranes may be ruptured, provided there is no fever and no gross contamination through repeated vaginal examinations and attempts at delivery from below.

longitudinally, it is possible to extend it into the body of the uterus when delivering a voluminous fetus. This may result in a weak spot at the upper end of the incision, as I have observed it. The transverse incision offers three distinct advantages, namely, (1) it avoids encroaching upon the uterine musculature and allows the placing of the incision entirely in the lower segment; (2) the bladder separation does not have to be carried as far downward, and (3) repeated operations are simpler to perform. What has been said about the low or cervical cesarean section in regard to the test of labor also applies to this method.

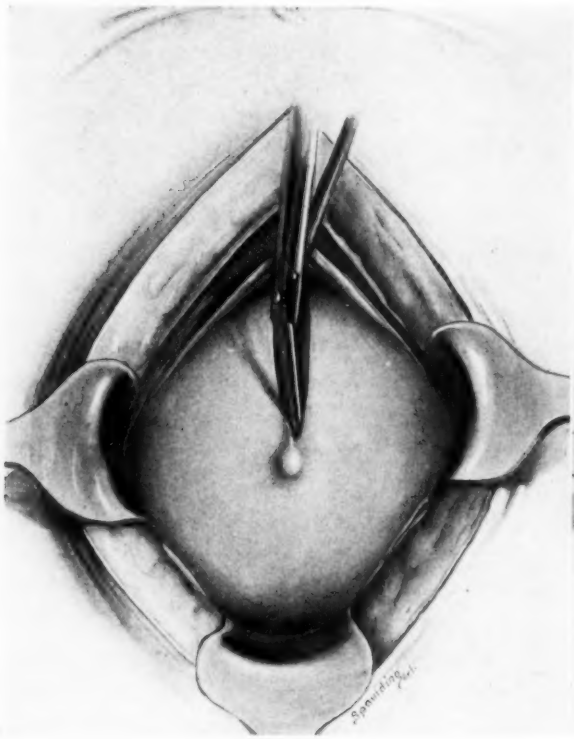

Fig. 1.

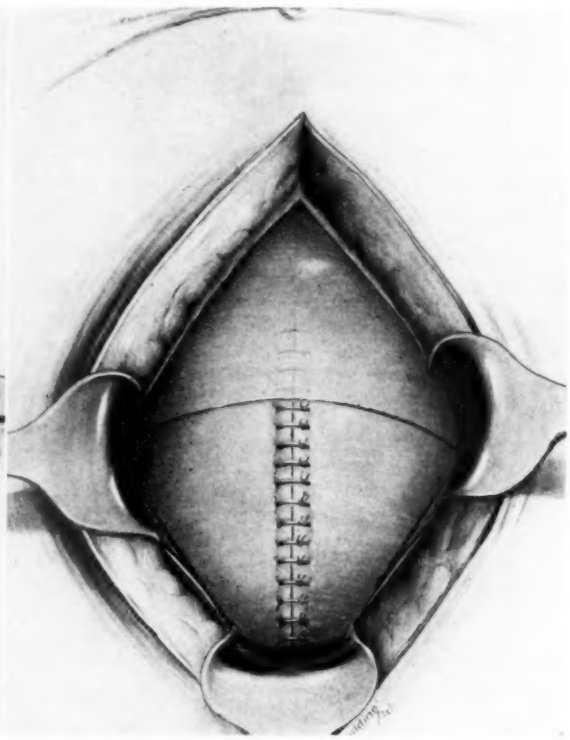

Fig. 2.

Fig. 1. Low or Cervical Cesarean Section (longitudinal incision, Krönig-Beck-DeLee). Low median supra-symphyseal incision. A lower flap of peritoneum is separated with the bladder which is held under the symphysis with a retractor; an upper flap of peritoneum is raised and held by an Allis forceps; a small incision is made at the upper end of the lower segment with a knife. The cervical incision is extended downward with bandage scissors to protect the child's head. (Phaneuf. *Am. Jour. Obst. and Gynec.*, 13: 446–457 [April] 1927.)

Fig. 2. Low or Cervical Cesarean Section (longitudinal incision, Krönig-Beck-DeLee). The infant is delivered and the placenta and membranes are expressed through the incision. The cervical incision is sutured in one layer with interrupted sutures of No. 2 chromic catgut. The upper flap of peritoneum is brought down but not anchored in any way to the uterus. The upper and lower flaps of peritoneum are united with a continuous suture of fine chromic catgut and the abdominal incision is closed in layers. (Phaneuf. *Am. Jour. Obst. and Gynec.*, 13: 446–457 [April] 1927.)

Transverse cervical cesarean section differs from the *Krönig-Beck-DeLee* operation in that the incision in the lower segment is placed transversely instead of longitudinally. The success of the low or cervical operation, in so far as good healing is concerned, depends upon placing the entire incision within the limits of the lower uterine segment. In making the incision

TECHNIQUE OF THE TRANSVERSE CERVICAL CESAREAN SECTION (FIGS. 3 AND 4)

Step 1, *Abdominal Incision.* The patient is catheterized, anesthetized and placed in the Trendelenburg position. The abdomen is opened by a median incision about 6 inches (15 cm.) long, starting at the symphysis and ending near the umbilicus. The peritoneal cavity is entered between the bellies of the recti muscles. A Doyen retractor is introduced at the lower angle of the incision and the lower uterine segment is well walled off with a long strip of gauze and at this time 1 c.c. of pitocin and 2 c.c. of ergoklonin are injected in the thigh muscles.

Step 2, *Cervical Incision, Delivery.* The uterine peritoneum, where it is loosely attached above the bladder reflection, is incised transversely and the bladder is pushed downward. The Doyen retractor is now placed over the bladder to protect it. The assistant makes traction upward on the uterus to bring the lower segment near the surface. A small transverse incision is made with a knife, as low as possible in the cervix, in the median line; this is extended laterally with bandage scissors, curving the incision upward, so as to give more room and to avoid the uterine vessels. The child is delivered by raising the head with the hand and making pressure on the fundus. Forceps are rarely necessary. If the breech presents, the infant is naturally extracted by the feet. If the patient has had no labor, or if the cervix is but slightly dilated at the time of delivery, the placenta and membranes are expressed through the incision. On the other hand, if the cervix is fully dilated, the cord is dropped in the uterus and the placenta is expressed through the vagina after the closure of the cervical incision and the suture of the peritoneal flap to the uterus. There is very little hemorrhage from the transverse incision.

Step 3, *Closure of Cervical Incision and Suture of Peritoneal Flap.* The cervical incision is closed in two layers, the first with interrupted and the second with a continuous suture, No. 2 chromic catgut being used; the first layer takes in part of the muscle; the second layer takes in the remainder of the myometrium and the fascia of the lower uterine segment and completely covers the first. The peritoneal edge at the bladder reflection is now sutured to the uterus above the cervical incision in the middle line with a suture of No. 0 chromic catgut, the ends of the catgut being left long, one end approximating the peritoneum to the uterus on one side and the other to the other side, thus completely covering over the transverse cervical incision and making it entirely retrovesical.

Step 4, *Closure of Abdominal Wall.* The gauze strip is now removed, the omentum is brought down and placed behind the uterus, (intestines are practically never seen during this operation), and the abdominal wall is closed in layers in the usual way.

This operation may be readily performed under local infiltration anesthesia, using a 1 per cent solution of novocaine.

Veit-Fromme-Hirst Transperitoneal Cesarean Section, (Peritoneal Exclusion) (Figs. 5 and 6). This method, which is known in this country as the Hirst operation or peritoneal exclusion, seals the lower segment by uniting the dissected visceral peritoneum to the parietal peritoneum, by means of catgut sutures, thus creating a space outside of the peritoneal cavity through which delivery may be accomplished. It is intended to keep the spill out of the peritoneal cavity, although it is fair to surmise that slight leakage may take place between the sutures. Be that as it may, the peritoneal cavity may be able to take care of that small amount in an infected woman when the whole spill might be overwhelming and might cause peritonitis. It does not offer as much protection as the true extraperitoneal method, but offers more than the intraperitoneal procedures. It therefore occupies an intermediate place between the extraperitoneal and the so-called low or cervical operations. Its protec-

tion against peritonitis is based upon the fact that the peritoneal layers are firmly adherent at the time the infection in the uterus becomes apparent. One of my own cases well illustrates this point. This young woman was admitted to my service after a long labor and repeated vaginal examinations; she had a large fetus which could not come through her pelvis. The peritoneal exclusion operation was performed and shortly thereafter signs of severe uterine sepsis appeared, the abdominal and the lower segment incisions broke down in their entire length; the fingers introduced through the abdominal incision reached the posterior wall of the lower uterine segment. The sepsis was so intense that the entire endometrium sloughed away and she has never menstruated since, yet, while all this was going on there was not the slightest peritoneal reaction, her bowels and bladder functioned normally and she was able to take considerable nourishment. The incisions eventually healed and mother and child left the hospital in excellent condition. I have performed 64 of these operations on women long advanced in labor and considered infected or presumably infected, none of whom developed peritonitis although 5 of them died, a mortality of 7.8 per cent. The causes of death were: pulmonary embolism; acute gastric dilatation; abruptio placenta and uterine apoplexy; myocarditis, pulmonary edema, bronchopneumonia; and eclampsia with suppression of urine.

FIG. 3.

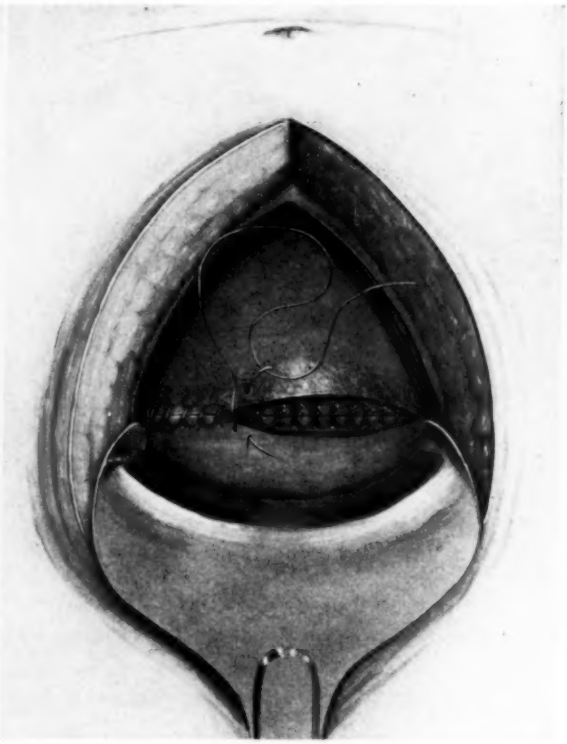

FIG. 4.

FIG. 3. Transverse Cervical Cesarean Section; low median suprasymphyseal incision. A flap of peritoneum is separated with the bladder which is held under a Doyen retractor. A half-moon curved incision with the concavity toward the symphysis is made in the lower segment. The ends of the incision are directed upward and parallel to the uterine vessels. The infant is delivered and the placenta and membranes are expressed through the incision. (Phaneuf. *Surg. Gynec. and Obst.*, 53: 202–204 [Aug.] 1931.)

FIG. 4. Transverse Cervical Cesarean Section. The cervical incision is sutured in two layers, the first with interrupted sutures, the second with a continuous stitch burying the first layer, No. 2 chromic catgut being used. The bladder peritoneum is then united to the uterus above the cervical incision with a running suture of fine chromic catgut thus making the cervical incision retrovesical and retroperitoneal. (Phaneuf. *Surg., Gynec. and Obst.*, 53: 202–204 [Aug.] 1931.)

Latzko extraperitoneal cesarean section (*Figs.* 7, 8 *and* 9) is probably the safest of all conservative cesarean sections, since, in its performance, the peritoneal cavity is not entered at all. The technique is somewhat more difficult than that of the other conservative methods, but it offers no insurmountable obstacles to the trained pelvic surgeon. In 1923 Jellinghaus introduced this method at the New York Lying-In and the Nursery and Child's hospitals. Since then a number of American obstetricians have become interested in it and several important papers have been published. In the February, 1932, Bulletin of the Lying-In Hospital of the City of New York, Steele analyzed 59 cases done by this method in that institution with 5 maternal deaths, or about 8.5 per cent. The bladder and peritoneal sac may be inadvertently opened during the dissection, they may be repaired immediately and these accidents will not mitigate from the good results of this procedure. Drainage is essential and this also acts as an added protective measure.

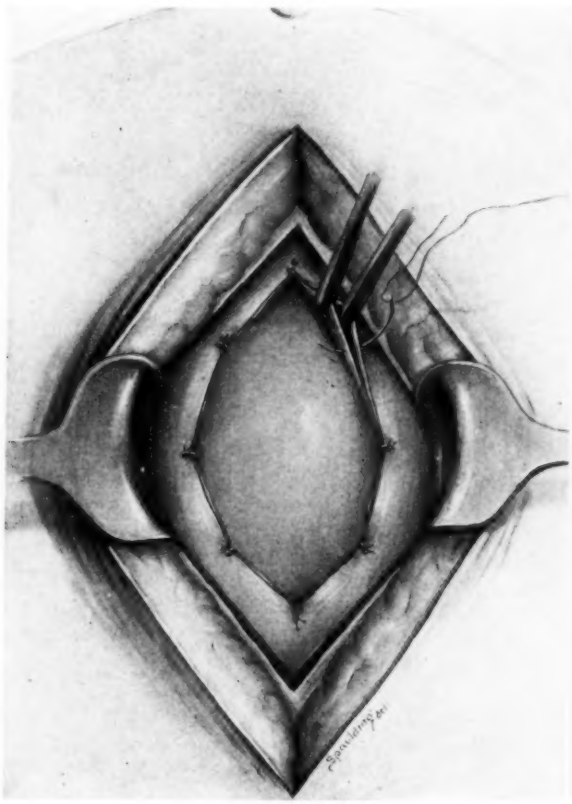

Fig. 5.

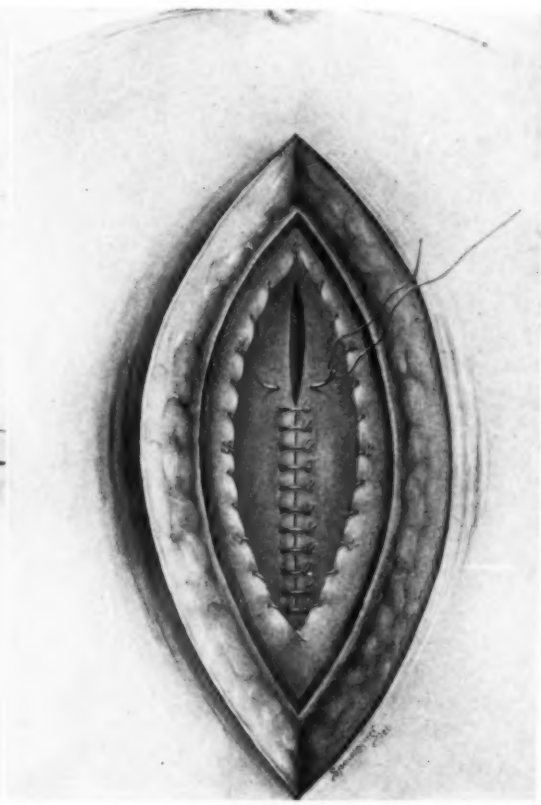

Fig. 6.

Fig. 5. Veit-Fromme-Hirst Operation (peritoneal exclusion). A median suprasymphyseal incision is made. The bladder and visceral peritoneum are separated from the lower uterine segment. The layers of parietal and visceral peritoneum are united by interrupted sutures of chromic catgut, thus walling off the lower uterine segment from the general peritoneal cavity. Sutures are less likely to tear the peritoneum than clamps.

Fig. 6. Veit-Fromme-Hirst Operation (peritoneal exclusion). The child is delivered and the placenta and membranes are expressed through the incision. The cervical incision is closed in one layer with interrupted sutures of No. 2 chromic catgut. The peritoneal layers are further approximated by a continuous suture of fine chromic catgut. The cervical incision is thus isolated from the peritoneal cavity. Drainage to the cervical incision may be instituted when deemed necessary.

Gottschalk-Portes operation, or temporary exteriorization of the uterus is reserved for the occasional hopelessly infected patient where the matter of the time element is a serious consideration. A long abdominal incision is made which permits the delivery of the pregnant uterus and its contents, the uterus is raised toward the symphysis pubis,

the upper part of the abdominal incision is closed by through and through silkworm gut sutures, leaving the lowermost ones

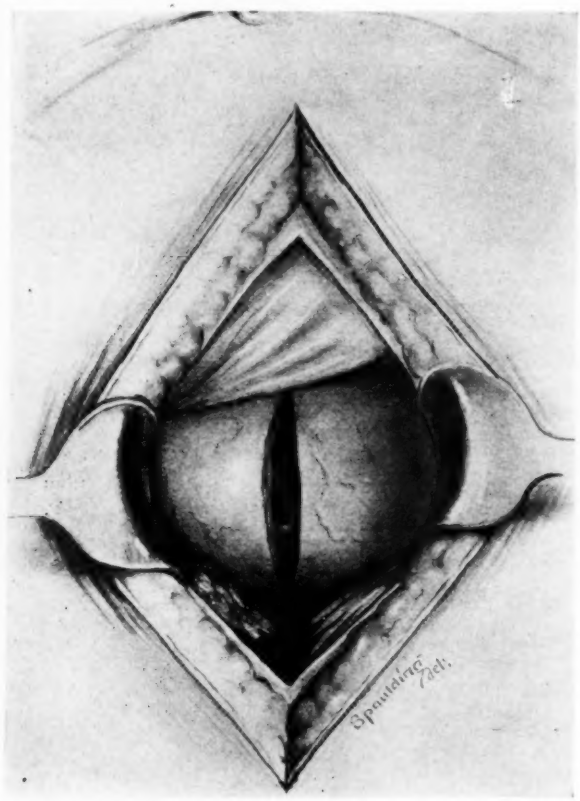

FIG. 7. Latzko Extraperitoneal Cesarean Section. A median suprasymphyseal incision is made. The intact peritoneal sac is dissected upward, the bladder is displaced to the right, thus exposing the lower uterine segment through which a longitudinal incision is made.

united in order to leave sufficient room for the delivery of the head, the upper abdomen is covered with sterile towels and the pregnant uterus is allowed to rest on it, a high fundal incision is made in the uterus and delivery is effected through it, the uterine incision is closed with catgut, the lower silkworm gut sutures in the abdominal wall are tied, the uterus is left out of the peritoneal cavity and is covered with moist dressings. But little time is required for performing this operation, and treatment for shock is instituted as soon as the patient is returned to bed. If the sepsis seems uncontrollable, the uterus may be removed supravaginally by the Porro technique when the patient is out of shock, and this may be performed without moving the patient from her bed. If the opposite obtains, the uterus is conserved. The uterine incision usually breaks down and separates, but eventually heals by second intention. When the local sepsis has subsided and the uterus has involuted, this organ may be returned to the peritoneal cavity. This operation, which I have performed twice on hopelessly infected women, where many attempts of delivery through the birth canal had been carried out, has resulted in 2 maternal recoveries and the survival of one infant. The first infant's skull had been fractured by attempts at forceps delivery. The uterus was exteriorized for forty-one days in the case of the first woman and for thirty days in the second. There was but little peritoneal reaction after returning the pelvic organs to the abdominal cavity.

The technique of this operation, as I have performed it, is described by means of illustrations in earlier publications.[2,10,11]

Porro Cesarean Section, or Cesarean Section Followed by Hysterectomy. In order to lessen the disastrous complications of hemorrhage and sepsis resulting from cesarean section in those days, Porro of Pavia, in 1876, advised the amputation of the body of the uterus and the adnexa above an elastic ligature wound around the cervix and the suturing of the cervical stump at the lower angle of the abdominal incision. With the advent of this method, the mortality of cesarean section was greatly reduced but the unsatisfactory feature was that it was so radical. With the development of the extraperitoneal methods, the indications for this radical procedure have become more and more limited. The present day indications are (1) severe sepsis in labor when vaginal delivery is undesirable, (2) in the presence of myomata, especially if large or situated ahead of the presenting part, thus obstructing labor, and (3) in severe and uncontrollable hemorrhage from placenta previa, ablatio placentae and uterine apoplexy, (Couvelaire uterus). Cancer of the cervix, osteomalacia, placenta accreta, uncontrollable postpar-

tum hemorrhage and the rupture of the uterus are rarer indications for hysterectomy. In 1931 I reported[5] 25 consecutive Porro cesarean sections without maternal mortality and with a fetal mortality of 16 per cent. Of the 22 children born alive, only one did not survive, a corrected fetal mortality of 4.5 per cent.

Fig. 8.

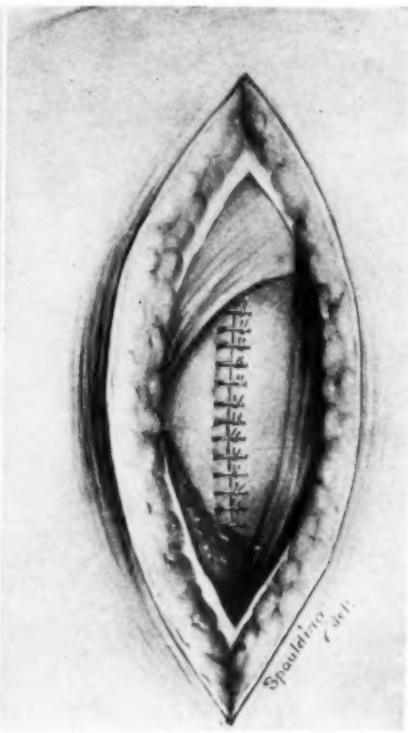

Fig. 9.

Fig. 8. Latzko Extraperitoneal Cesarean Section. Solid blade forceps are used in delivering the head so as not to mark the baby's face. The infant is delivered and the placenta and membranes are expressed through the incision.

Fig. 9. Latzko Extraperitoneal Cesarean Section. The cervical incision is closed in one layer with No. 2 chromic catgut. A cigarette drain is introduced to the cervical incision, the peritoneal sac and the bladder are allowed to resume their normal positions and the abdominal incision is closed in layers.

AFTER CARE

During the operation 1 c.c. of pitocin and 2 c.c. of ergoklonin have been injected intramuscularly. The uterus is usually firmly contracted as the patient is returned to her bed. Eserine sulphate, gr. $\frac{1}{50}$, (0.0013 gm.) is given subcutaneously every four hours for four doses, the first dose when the puerpera is out of anesthesia. She is given morphine sulphate, gr. $\frac{1}{6}$, (.010 gm.) hypodermically every four hours if necessary to control pain. She is catheterized every six to eight hours if she does not void readily, in order to prevent bladder distention and traction on the suture line which attaches this viscus to the uterus. If the patient voids, she is catheterized for residual urine and this is repeated until it is assured that the bladder empties itself completely. The day after operation the patient is allowed a soft solid diet. The morning of the third day she is given mineral oil, one ounce, (30 c.c.) and milk of magnesia, one half ounce, (15 c.c.). A low soap suds enema is given on that day if necessary. High enemata and drastic cathartics are never employed. After the first evacuation a 5 grain (0.300 gm.) cascara tablet is prescribed as necessary. By following this regime we seldom encounter intestinal distension. By the fourth or fifth day the patient is given a generous diet and she is allowed to nurse her child

as she would under normal conditions. The abdominal sutures are removed on the ninth postoperative day; she is allowed to sit up straight in bed on the tenth day, allowed out of bed on the twelfth day and is usually discharged from the hospital on the fourteenth postoperative day.

SUMMARY

The literature of the last decade shows that a large number of obstetricians are resorting to the low or cervical cesarean section instead of the classical or Sänger operation. Since the early part of this century, the indications for cesarean section seem to have increased, perhaps, because of the better results obtained by the low operation. The tendency of the present time is to restrict rather than to increase the indications. The important indications are given in detail. When a cesarean section has been decided upon the surgeon has the choice of eight methods, as follows: (1) vaginal cesarean section; (2) the Sänger classical cesarean section; (3) the low or cervical cesarean section, with a longitudinal incision, (Krönig-Beck-DeLee); (4) the transverse cervical cesarean section; (5) the Veit-Fromme-Hirst transperitoneal cesarean section, popularly known as peritoneal exclusion; (6) the Latzko extraperitoneal operation; (7) the Gottschalk-Portes operation, or exteriorization of the uterus; and (8) the Porro operation, or cesarean section followed by hysterectomy.

The condition of the patient will govern the choice of the method. The low or cervical cesarean section may be used safely after an adequate test of labor. The peritoneal exclusion method of Veit-Fromme-Hirst occupies an intermediate place between the low or cervical cesarean section and the true extraperitoneal procedure of Latzko. Of the conservative methods, the Latzko operation gives the infected parturient the greatest protection against peritonitis. Exteriorization of the uterus and hysterectomy are reserved for the occasional severely neglected patient. The indications for the Porro operation are presented. The technique of the different methods is discussed and supplemented by illustrations.

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STERILIZATION AT CESAREAN OPERATION*

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IN a large maternity clinic, a certain number of patients have a cesarean section who really should be sterilized because of cardiac, kidney or lung disease that makes repeated pregnancies dangerous to life. For many years we have been forced to perform such operations occasionally and each time we have felt keen dissatisfaction with the standard methods in use. The blood supply at the uterine cornu is so rich at the time of a section that the loss of blood seems unnecessarily great. The time consumed is out of all proportion to the simple thing you are trying to accomplish. The cut area left to heal is no slight addition to the burden placed on the body tissues that already have the task of closing the operative wound and those raw areas at the cornua seem additional foci for a possible periotonitis.

The standard operations for sterilization may work well in the case of a non-pregnant woman but there is quite a different story with the vascular uterus at the time of delivery. We find these objections apply to the resection of the tubal insertion, with the burial of the distal end in the myometrium, as described by Slemons[1] and Neller.[2] A modification by Fuchs[3] is an excellent operation, but even more time consuming. Little better are the methods based on implanting the distal cut end of the tube between the split peritoneal layers of the mesosalpinx, as advocated by many operators.

A recent group of such cases seen during a short time drew our attention back to a method of sterilization that we have tried occasionally during the past eight years. The tube is held straight and rigid for a distance of about 3 cm. out from the cornu. We use a special clamp that has two parallel rubber covered prongs that just touch. This is slipped under the tube, bridging the mesosalpinx, as indicated by the black outline in Figure 1. Thus the tube is held straight, with uniform counter-pressure to insure accurate incision. The tube may, however, be held fairly satisfactorily between the index and middle fingers of an assistant. The tube is split through the peritoneum and muscularis for a longitudinal distance of about 3 cm. The pale, glistening mucosa tube, which is surprisingly tough, is met and freed, just as you would pick up a vein in a venesection. If the incision is not carried too near the cornu there is practically no bleeding. The exposed mucosa tube is ligated at both ends of the incision, and the portion between the ties is cut away. The empty sheath of peritoneum and muscularis is now folded into an "s," after removal of the clamp. Through-and-through fine black silk sutures are placed and tied, as indicated in Figure 2. Silk is used to prevent any possible straightening of the tube before its cavity has been thoroughly obliterated by scar tissue.

We note that the German method of state sterilization of defective women[4] is also based on mucosa excision, though their technique would cause more hemorrhage after cesarean section than does ours, as it involves an incision running into the cornu.

Neater and more satisfactory methods of placing the sutures and of obliterating the dead space of the excised mucosa may occur to us. However, we have sought the simplest, quickest, least bloody way that can produce the desired result. The class of patients we have in mind are poor surgical risks; some are under local anesthesia at the time of operation. We have felt it wise to try to save every possible minute and every drop of blood possible.

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It seems almost impossible to find a method of sterilization against which it may not be charged that an occasional preg-

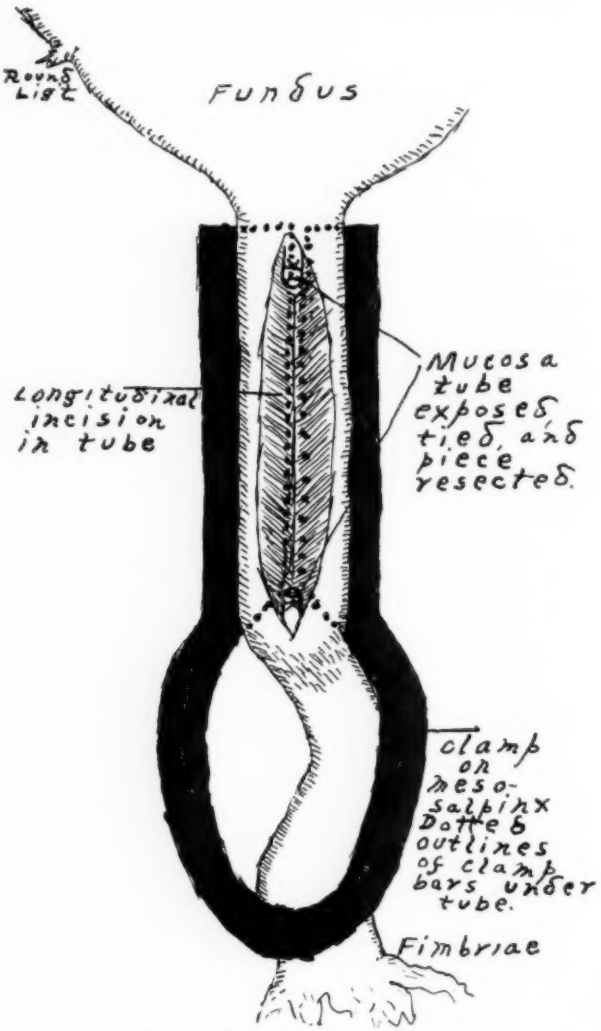

Fig. 1. Tube incised over clamp.

nancy has followed in spite of the best technique. For example, Brunner[5] reports such a failure after the implantation of the cut tube into the myometrium. Possibly we shall meet the same disappointment when we have a sufficiently large series of cases. To date, we have tried our method on 6 patients, over a period of eight years. Where time and the patient's condition permitted we have stuck to more orthodox technique. So far, no pregnancy has occurred in any woman treated by this mucosa resection method.

I wish to express my gratitude to Dr. Arthur H. Bill for the opportunities he has given me to apply this sterilization method to patients on the service of the Maternity Hospital of Cleveland.

SUMMARY

A description is given of a technique for sterilization at cesarean operation intended for patients who are poor surgical risks, when it is imperative to save time and loss of blood. A special clamp or the fingers of an assistant placed along the mesosalpinx, holds the tube straight and affords counter-pressure. A lengthwise incision is made through the muscularis of the tube in the isthmic region. The mucosa tube is lifted from its bed and about 1 cm. excised between ligatures. The empty sleeve muscularis is folded in an "s" and secured in that position with three or four through-and-through fine silk sutures.

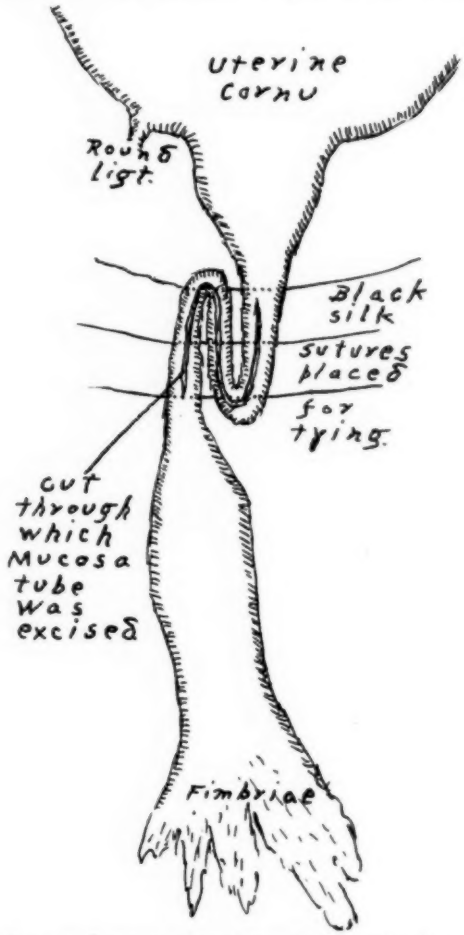

Fig. 2. Sutures placed for closure of tube.

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THE ABUSE OF CESAREAN SECTION*

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ONE of the serious criticisms of modern obstetrical practice is to be found in the frequency with which cesarean sections are performed. The development of the modern types of operation and the improvement in general surgical technique have resulted in a very considerable broadening of the indications for the performance of the operation as compared with those indications which were considered adequate a generation ago. This is to be expected, and while pelvic dystocia still is, and probably always will be the chief indication for the performance of cesarean section, yet there are numerous other situations in which delivery in this manner may well be the procedure of choice. At the same time, however, it would appear that this broadening of the indications for the operation has at times resulted in a more or less indiscriminate resort to it as a means of delivery, and often it is performed on pretexts that may fairly be regarded as trivial. Some idea of the frequency with which cesarean sections are performed may be obtained from the report of the New York Academy of Medicine on maternal mortality in New York City from 1930–1932 and from the similar report of the Philadelphia County Medical Society for 1931, 1932 and 1933. In New York the deliveries by cesarean section constituted 2.2 per cent of all deliveries occurring in the hospitals reporting, while in Philadelphia the figure was 2.6 per cent. These figures are more than twice as great as those reported from most European clinics. The gross mortality recorded in the New York series was 6.1 per cent, while in Philadelphia it was 5.6 per cent.

That the operation is being abused and is performed many times unnecessarily is unquestionable, and that many women die each year as a result of this abuse is equally true. As I see the situation, it would appear that this abuse of cesarean section is brought about in one or more of three ways, namely (1) extreme laxness in the recognition of proper indications for the operation, (2) failure to perform the operation at the proper time, or (3) poor judgment in the selection of the proper type of cesarean section when the operation is indicated. These three factors all contribute their share to the unnecessarily high mortality which attends the performance of cesarean sections.

In discussing legitimate indications for the performance of cesarean section, that of pelvic dystocia still occupies first place, and probably always will. It is of the greatest importance to remember, however, that the mere diagnosis of a contracted pelvis does not necessarily demand the performance of cesarean section. Thus the late J. Whitridge Williams found in his series that including all types of contracted pelvis, delivery through the natural channels could be expected in nearly 80 per cent of such women. Whether such an outcome is possible or not will obviously depend on such factors as the type and degree of contraction present as well as the size of the child and the consistency of its head. In many women presenting contracted pelves the decision as to the line of procedure to follow is not difficult for the experienced person. Thus those presenting extreme degrees of pelvic contraction should ordinarily be delivered by cesarean section at an elective

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time or at the onset of labor, while in those women presenting only slight pelvic deformity a spontaneous outcome may well be expected. The so-called "border-line" group presenting degrees of contraction between these two extremes is the one which requires the nicest obstetrical judgment before a proper decision as to the proper line of procedure to follow can be reached. From the standpoint of pelvic dystocia, it is in these two latter groups that the greatest abuse of the operation exists and it is in women in these two groups upon whom many unnecessary operations are performed, largely on account of poor judgment on the part of the attendant, and his failure to appreciate what can be accomplished by the natural forces.

Antepartum hemorrhage, whether due to placenta previa or premature separation of the placenta, is the indication for cesarean section in an increasing number of patients. At times this may well be much the best procedure to follow, but to employ it as a routine procedure in all patients presenting these abnormalities is most decidedly to be regarded as an abuse of the operation. A high percentage of the less severe forms of these complications can be quite satisfactorily and often more safely treated by more conservative obstetrical measures. Here again is a situation in which careful judgment and proper selection of patients will give better results than is possible with indiscriminate resort to the scalpel.

Less frequently, the operation may be definitely indicated at times in abnormal presentations, or in the presence of pelvic tumors which offer a mechanical obstacle to the birth of the child. Generally speaking, however, the majority of abnormal presentations can be handled safely by more conservative means, and the mere diagnosis of a breech, transverse, or face presentation should never in itself be considered a sufficient indication for the operation, and only if there be other complicating factors present would one be justified in resorting to it. In the case of pelvic tumors of one kind or another, the tumor may be so situated as to block the pelvis completely. Under these circumstances, no one can criticize the performance of cesarean section, but if the size and situation of the tumor is such as to offer no real obstacle to the completion of labor, it would certainly seem to be an abuse of the operation to resort to it under such conditions. More logical treatment would seem to be to care for the tumor at some time after delivery has occurred.

Cesarean section formerly enjoyed a considerable vogue as the means of delivery in women suffering from eclampsia. Fortunately it is not performed for this condition as often as formerly, but too many operations are still performed on this indication. The operation should have no place in the treatment of eclampsia unless there be an associated mechanical obstacle to delivery. The results, in so far as the treatment of eclampsia itself is concerned, are infinitely superior when one of the conservative methods of therapy is followed.

Indications for the operation which are not purely obstetrical are found particularly in women in late pregnancy who are suffering from various forms of heart lesions, pulmonary tuberculosis or nephritis. Their general condition may be such as to make it evident that they cannot safely withstand the physical strain of labor, and the operation is done for this reason, or it may be desired to combine delivery and sterilization in one procedure. In many instances this will be a legitimate procedure, but it should always be remembered that these patients are poor operative risks at the start, and for this reason the operation should never be lightly undertaken on such indications. Preferably it should be done only after due consultation with a competent internist who will give the obstetrician the benefit of his opinion in properly assaying the risk involved. Unfortunately, the patient is just as dead if she dies as the result of the operation as though she had died as a result of the condition for which the operation was performed.

In quite a number of instances cesarean sections, particularly those of the classical type, have been followed by a rupture of the uterine scar in a subsequent pregnancy or labor. To avoid this serious accident, many feel that all subsequent pregnancies should be terminated in a similar manner, and thus has originated the dictum "once a cesarean always a cesarean." With the increasing frequency with which the operation is performed for other than pelvic indications, this becomes a matter of major importance. If one can be sure in a particular instance that the danger of rupture of the old scar is a very real one, no criticism can be offered if the succeeding pregnancy be terminated by cesarean section, whereas, if the danger of rupture is absent, the operation will be unnecessary except in the case of women who present marked pelvic deformity. Williams showed very clearly that following the classical section, if no infection occurs, the healing of the uterine wound is so perfect that the scar often cannot be identified even by microscopic examination. Such a scar should well withstand the strain of a subsequent pregnancy or labor, and repeated cesarean section in these circumstances should be unnecessary. On the other hand, if the convalescence from the original operation has been attended by infection, the healing of the uterine wound may well be imperfect and rupture may occur. With these points in mind, an accurate knowledge in regard to the course of events following the original operation is essential before a proper decision as to the line of procedure to be followed in a subsequent pregnancy can be made. Proper evaluation of the information obtained along these lines should, however, help in materially reducing the number of cesarean sections unnecessarily performed.

The other particular factors in the abuse of the operation namely, failure to perform the operation at the proper time and poor judgment in regard to the choice of the type of operation to be performed, present many points in common and will be discussed together. The classical type of operation is still the one which is most frequently performed and the number of this type performed would appear to far outnumber all other types of cesarean section. There are two reasons for this. First, the technique of the operation is comparatively simple and anyone with the rudiments of surgical training is apt to feel perfectly competent to perform it. It is therefore the operation most likely to be chosen by the occasional obstetrical operator of limited experience or by the general surgeon who is called in consultation to see some obstetrical complication. The second reason for its frequency is to be found in an apparently widespread, but highly erroneous idea as to its safety. It is difficult to arrive at accurate conclusions as to just what the mortality of this operation is for the country at large, but from the reports that are available, a gross operative mortality of 10 to 12 per cent would seem to be a conservative estimate. This is entirely unnecessary and is due to the failure of the profession at large to appreciate the fact that the time of performance of the operation in its relationship to labor is a fundamental factor in so far as its safety is concerned. Reynolds, Williams, Eardley Holland, and others have written repeatedly on this aspect. All agree that the operative mortality of the classical cesarean section on properly selected patients should be low if it be performed either at an elective time before labor sets in at all or at the very onset of labor. Under these circumstances the mortality should not exceed 2 per cent. Thus Eardley Holland in 1591 operations showed a mortality of 1.7 per cent, Williams in 255 operations had a similar mortality, while my own unpublished figures are comparable, and show 2 deaths in 143 operations, a mortality of 1.4 per cent. They also showed that the mortality rises progressively for every hour the patient is in labor before the operation is done, reaching 10 per cent when done late in labor and the prohibitive figure of nearly 30 per cent when done after attempts at delivery from below had been made. These latter figures

are appalling, and yet in spite of these demonstrated facts, many operators continue to ignore them and perform the operation at a time when the results are bound to be disastrous.

When the patient is seen late in labor and a legitimate indication for cesarean section exists, the time for the classical operation has passed and under no circumstances should it be considered. Provided the patient's condition is good and the child is alive, this is the situation where par excellence the so-called low cervical cesarean section should be the operation of choice. The mortality attending it should not exceed 2 per cent as compared with the higher figure attending the classical operation done under similar circumstances. Technically, the operation is more difficult than the classical operation, and is not to be lightly undertaken by the occasional operator. This type of operation may also be done as an elective procedure and many prefer it to the classical operation. Performed under these conditions, the results are excellent.

Various forms of extra-peritoneal operation have been devised to be used late in labor. Of these the Latzko technique is the one most widely employed. This is technically still more difficult than the low cervical type and is most assuredly an operation that is not to be done by the occasional surgeon. The field of usefulness of this operation extends very slightly beyond that of the low cervical operation and most operators prefer the latter.

The frankly infected woman, seen late in labor, and who presents a mechanical obstacle to the completion of labor is always a serious problem. To do a classical operation under such circumstances is practically to sign her death warrant, and yet this very procedure is still done too often on this type of patient. Even the low cervical section cannot be regarded as a safe procedure under such circumstances. It is in this situation that the cesarean section will have to be followed by removal of the uterus, either total or subtotal, the so-called Porro operation. Other situations where it may be indicated will be found occasionally in such conditions as acute intra-uterine hemorrhage associated with premature separation of the placenta where there may be such dissociation of the uterine musculature that the bleeding is otherwise uncontrollable, in rupture of the uterus, or when obstructing myomata are of such a size or in such a position as to warrant removal of the uterus. It should be the least frequently performed type of operation. The mortality will probably always be somewhat higher than in the other types of operation, though in the frankly infected patient presenting pelvic dystocia the results will be infinitely superior to those obtained from the classical operation done under similar circumstances. Here again is a procedure which should only be undertaken after careful consideration of all the factors involved, and one which is most distinctly susceptible to abuse by operators of unsound judgment and inadequate obstetrical training.

From what has been said, it should be apparent that the broadening of the indications for cesarean section has resulted in such an indiscriminate resort to it as a means of delivery as to constitute an abuse of the operation. This in turn has resulted in an unnecessarily high mortality of such an extent as to be a very real factor in increasing the already too high maternal mortality of the country as a whole. Paradoxical as it may seem, the poorest results appear to follow the classical operation which technically is the easiest to perform. This is almost invariably due to the failure of operators to realize the limitations of safety in so far as the proper time for the performance of the operation is concerned. To emphasize what was previously stated, this operation is not to be regarded as a safe procedure unless it be done as an elective procedure before labor sets in or at the onset of labor. Performed late in labor the menace to the patient is too great to ask her to face it.

CONCLUSION

What can be done to correct the abuse of what should be a life-saving measure for mother and child? Here again is a situation where better clinical training on the part of those who propose to practice obstetrics should go far to combat the evil. The well trained individual will acquire a proper understanding of the forces concerned in labor, and also a proper appreciation of what Nature can accomplish as well as the limitations. Above all he should acquire what may well be called an obstetrical conscience. Such a man would surely not resort to cesarean section unless he had a clear cut indication for it, and should have developed such a degree of technical skill and clinical judgment as to be able to recognize the legitimate indications, and to choose the proper type of operation at the proper time. As Williams once expressed it "what we need in this country are more thoroughly competent obstetricians and fewer skillful, but indiscriminate surgeons."

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

POTT AND HUNTER

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THE two great contemporary English surgeons of the eighteenth century were Pott and Hunter and both lived in London. Percival Pott (1714–1788) was fourteen years the senior of John Hunter (1728–1793) and died but five years before him. They were little alike in character and their attainments were likewise as varied, though they were often associated during their lives. Hunter, in 1751, soon after he came to London to work with his brother, William Hunter, became the pupil of Pott, studying clinical surgery under him at St. Bartholomew's Hospital. In 1753, they were simultaneously elected to fill two vacancies as Masters of Surgery in the recently formed, but short-lived, Surgeons' Company. Peachy tells us that "The duties of the Masters were to read such lectures on anatomy as should be approved by the Court of Assistants." In later years they became rivals in the practice of surgery, though Pott appears to have had the more lucrative following.

Pott was essentially a clinician and represents the height to which the art of surgery of that day had progressed. Sir D'Arcy Power says that "his name is better known on the Continent than that of any other English surgeon except Lister . . . better even than that of John Hunter . . . by the rank and file who have no knowledge of the history of surgery."[1] "His high character and blameless life helped to raise the surgeons social standing."[2] "Mentally he was not much in advance of his time, for scientific surgery had not yet come into being, and he was essentially a clinical surgeon, who observed what he saw and taught his pupils to follow his example."[1] He did much to make surgery more humane and simplified the forms of treatment. He advised against the use of mechanical devices, which had been in use for centuries, for the production of traction and countertraction in the reduction of fractures of the long bones, recommending as a substitute positions of the limbs in which the muscles were relaxed. He believed that muscular relaxation was the first perquisite to a proper alinement of the fragments and that the old methods were not only unsound in their principles but their use often caused additional injury, due to the inability of the surgeon to judge the force that was applied.

[1] *Brit. Jour. Surg.* 17: 1 (July) 1927.

[2] Dictionary of National Biographies. London. 46: 207.

Pott was a popular teacher and his lectures were attended by enthusiastic students, who carried his views on surgery to all parts of the British Isles and often to the Continent. He did not begin to write until he was forty-three years of age, when at frequent intervals his writings began to appear in pamphlet form, practical papers on the treatment of hernia, hydrocele, fistula of the lacrimal duct, head injuries, fractures, paralysis due to disease of the vertebra, and discourses on many other diverse subjects. Fourteen of these pamphlets were published and were sold for one shilling and sixpence each. As the author wrote clearly and intelligently, they were much sought and were read with interest and profit.

John Hunter, on the other hand, did not take kindly to the practical side of surgery, for he was not primarily a clinician and thought poorly of the attainments of the surgical practice of those days, for he said, "To perform an operation is to mutilate a patient who we are unable to cure; it should therefore be considered as an acknowledgement of the imperfection of our Art." Hunter had a rare intellect and a keen power of reasoning. Unlike Pott, he knew little of the writings of the "Old Masters," for he had neither the time nor the inclination to read their works.

Hunter wrote on subjects of a far different nature than Pott or other physicians or surgeons who preceded him. These subjects were diverse; biology, anatomy, comparative anatomy, fossils, physiology and pathology. He told of new observations he had made and of experiments which he had performed. He drew conclusions from the facts he gathered which, though not always correct, often pointed the way to the truth for others who followed him. For, through his writings, he introduced new modes of unraveling the secrets of life.

He was an investigator and was more interested in discovering the fundamental facts of life than he was in the practice of the art of surgery and, in consequence, his name will always stand as that of a man who introduced scientific thought into the practice of our profession. That is why it is said "he raised surgery from a trade into that of a profession." Buckle, in his "*History of Civilization in England,*" wrote

> I have now only one more name to add to this splendid catalogue of the great Scotchmen of the eighteenth century. But it is the name of a man, who for comprehension and original genius, comes immediately after Adam Smith, and must be placed far above other philosophers who Scotland has produced. I mean of course John Hunter, whose only fault was an occasional obscurity, not merely of language, but also of thought. In this respect, perhaps, in this alone, Adam Smith had the advantage; for his mind was so flexible, and moved so freely, that even the vastest designs were unable to oppress it. With Hunter, on the contrary, it sometimes seemed as if the understanding was troubled by the grandeur of its own conceptions, and doubted what path it ought to take. He hesitated; the utterance of his intellect was indistinct. Still, his powers were so extraordinary, that, among the great masters of organic science, he belongs, I apprehend, to the same rank as Aristotle, Harvey, and Bichat, and is somewhat superior either to Haller or Cuvier.

This is a remarkable eulogy, but nevertheless one that is well deserved.

It is impossible to compare these two men for their attainments were so different. Pott was the greatest clinician of his time and made many improvements in the methods used in the treatment of disease. He was, moreover, an outstanding teacher of the practice of surgery and his views were recognized through the civilized world. Hunter, on the other hand, was interested in research; he wished to find the underlying principles of life. He demonstrated the value of laboratory investigation and showed that the study of disease could not be complete without the discovery of what he called the "principles of life" and the effect of disease upon them. Today these principles are taught under the names of physiology and pathology. Hunter, because of inhibitions, was a poor

teacher as he lacked the power to clearly express his thoughts, and consequently his classes were small. There were, however, a few of his pupils who were able to comprehend the nature of what they heard and to spread these new doctrines to others.

To summarize, Pott was a great practical surgeon and clinical teacher. Hunter, however, was the greater of the two, for he was an outstanding philosopher and, by introducing scientific thought into the practice of surgery, established a firm foundation for its practice. He was a keen observer and a sane accumulator of facts, from which he deducted the laws of Nature. Not only did he introduce entirely new methods into the practice of surgery, but also taught his views to others, who expounded them and carried them to the next generation. We need but mention Jenner, Cline, Home, Abernathy, Baillie, Astley Cooper and Physick as some of his disciples, each one of whom taught the Hunterian methods.